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Smith

18

REVIEW OF APPLIED ENTOMOLOGY

SERIES A: AGRICULTURAL.

VOL. III.

THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

VOL. III.

ISSUED BY THE IMPERIAL BUREAU OF ENTOMOLOGY.

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ERRATA.

Page	7	line 15	for	" *memorum* "	read *nemorum.*
,,	8	,, 29	,,	" Dobrodjev "	,, Dobrodeiev.
,,	9	,, 1	,,	" Emelianoff "	,, Emelianov.
,,	10	,, 41	,,	" *Cephalonomyia* "	,, *Cephalonomia.*
,,	15	,, 15	,,	" *Petrograd* "	,, *Pavlograd.*
,,	26	,, 16	,,	" *Brachisbella* "	,, *Abbella* (*Brachystella*).
,,	32	,, 23	,,	" Burrel (M.) "	,, Hewitt (C. G.).
,,	33	,, 16	,,	" *leontondonis* "	,, *leontodontis.*
,,	42	,, 37	,,	" with "	,, to.
,,	45	,, 49	,,	" *Brachocolus* "	,, *Brachycolus.*
,,	47	,, 36	,,	" *Widhalmi* "	,, *Wildhami.*
,,	48	,, 32	,,	" Turkum "	,, Tukum.
,,	52	,, 23	,,	" *Malocosoma* "	,, *Malacosoma.*
,,	54	,, 25	,,	" *Syphoryne* "	,, *Syphocoryne.*
,,	57	,, 1	,,	" auchere (A.) "	,, Fauchere (A.).
,,	66	,, 42	,,	" *Gryllotalapa* "	,, *Gryllotalpa.*
,,	79	,, 43	,,	" 875–884 "	,, 875–882.
,,	83	,, 13	,,	" *Lepidoaphes* "	,, *Lepidosaphes.*
,,	85	,, 28	,,	" *Aulascaspis* "	,, *Aulacaspis.*
,,	85	,, 7	,,	" *ramasa* "	,, *ramosa.*
,,	88	lines 43 & 51	for	" *S. obscurus* "	,, *R. obscurus.*
,,	88	line 31	for	" Mingworth (J. F.) "	,, Illingworth (J. F.).
,,	94	,, 22	,,	" *Onophlus* "	,, *Omophlus.*
,,	94	,, 46	,,	" Barim "	,, Barium.
,,	98	,, 21	,,	" Andrejeva "	,, Andreieva.
,,	99	lines 24 & 26	for	" *vibesii* "	,, *ribesii.*
,,	103	line 19	for	" Zvyerezomb-Zybovsky "	,, Zvierezomb-Zubkovsky.
,,	110	,, 35	,,	" *Bracon abcissor* "	,, *Bracon abscissor.*
,,	111	,, 31	,,	" *Ежэгодникъ* "	,, *Ежегодникъ.*
,,	113	,, 10	,,	" Rhynchsta "	,, Rhynchota.
,,	118	,, 42	,,	" V. E. Eudev "	,, V. E. Ender.
,,	119	,, 24	,,	" майекаго "	,, майскаго.
,,	123	,, 48	,,	" Redmont "	,, Piedmont.
,,	127	,, 23	,,	" **mczzi** "	,, **mezzi.**
,,	128	,, 1	,,	" *ячмена* "	,, *ячменя.*
,,	128	lines 32 & 33	for	" Podolsk "	,, Podolia.
,,	141	line 26	for	" *U.S. Bur. Agric.* "	,, *U.S. Dept. Agric.*
,,	145	,, 34	,,	" *isocratis* "	,, *isocrates.*
,,	147	,, 16	,,	" *Peozostethus* "	,, *Piezostethus.*
,,	147	,, 32	,,	" Vassiliev (E. M.) "	,, Vassiliev (M. E.).
,,	148	,, 26	,,	" *култура* "	,, *культура.*
,,	151	,, 15	,,	" *perplexcus* "	,, *perplexus.*
,,	153	,, 31	,,	" (*Protopanteles*) "	,, (*Protapanteles*).
,,	158	,, 17	,,	" Allen (W. T.) "	,, Allen (W. J.).
,,	172	,, 30	,,	" Krasnogarsk "	,, Krasny-Yar.
,,	173	,, 19	,,	" *Alomphale* "	,, *Allomphale.*
,,	180	,, 8	,,	" *novaboracensis* "	,, *noveboracensis.*

ERRATA—*cont.*

Page 181	line 45	for	" *damnificia* "	read *damnifica.*
,, 183	,, 1	,,	" *плодоводства и виноградства, и* "	,, *плодоводства, винoградарства и*
,, 187	,, 19	,,	" *Picrasma* "	,, *Picraena.*
,, 196	,, 19	,,	" *Isaria desa* "	,, *Isaria densa.*
,, 196	,, 22	,,	" *Cephronal bipes* "	,, *Cephron albipes.*
,, 198	,, 11	,,	" *Wagenigen* "	,, *Wageningen.*
,, 199	,, 47	,,	" *Setodiplosis* "	,, *Sitodiplosis.*
,, 220	,, 39	,,	" *P. pruniana* "	,, *O. pruniana.*
,, 221	,, 15	,,	" *Harpia* "	,, *Harpyia.*
,, 227	,, 15	,,	" *Riev* "	,, *Kiev.*
,, 230	,, 5	,,	" *citellus* "	,, (*Citellus*).
,, 234	,, 46	,,	" Krassilstchick "	,, Krassilstchik.
,, 242	,, 31	,,	" *Елиссаветопольскій* "	,, *Елисаветпольскій.*
,, 244	,, 11	,,	" *Ставрополскаго* "	,, *Ставропольскаго.*
,, 255	,, 3	,,	" no. 109 "	,, no. 108.
,, 259	,, 10	,,	" *Anystis agitis* "	,, *Anystis agilis.*
,, 279	,, 5	,,	" *erealium* "	,, *cerealium.*
,, 294	,, 23	,,	" 40 U.S. gallons (33⅓ Impl.) of water "	,, 40 gallons of water.
,, 326	,, 18	,,	" *gemmatilis* "	,, *gemmatalis.*
,, 338	,, 13	,,	" Tcheringov "	,, Tchernigov.
,, 351	,, 50	,,	" *Zylosteum* "	,, *Xylosteum.*
,, 367	,, 1	,,	" Rumsay "	,, Ramsay.
,, 382	,, 16	,,	" KEHRING (H.) "	,, KEHRIG (H.).
,, 389	,, 29	,,	" *vitallinae* "	,, *vitellinae.*
,, 401	,, 12	,,	" *Stethophygma* "	,, *Stethophyma.*
,, 405	,, 2	,,	" *по садочнаго* "	,, *посадочнаго.*
,, 415	,, 51	,,	" *Pseudopanteles* "	,, *Pseudapanteles.*
,, 420	,, 1	,,	" *Desnia* "	,, *Desmia.*
,, 420	,, 34	,,	" Oregeon "	,, Oregon.
,, 433	,, 30	,,	" *Aethognatus* "	,, *Aethognathus.*
,, 434	,, 7	,,	" *Aethognatus* "	,, *Aethognathus.*

In all abstracts from the Jl. Econ. Entom., Concord, on pages 444–459 inclusive, for *Vol. vii* read *Vol. viii.*

Page 458	line 11	for	" *Concord*, pp. 299–302 "	,, *Concord, viii*, no. 2, April 1915, pp. 299–302.
,, 458	,, 17	,,	" *Goniomyia* "	,, *Goniomima.*
,, 460	lines 26 & 28	for	" *objectus* "	,, *obtectus.*
,, 460	line 31	for	" *B. obsloetus* "	,, *B. obsoletus.*
,, 461	,, 18		Delete " *acris.*"	
,, 476	,, 42	,,	" *pica* "	,, *picta.*
,, 481	,, 22	for	" *Melanastoma* "	,, *Melanostoma.*
,, 494	,, 41	,,	" *uimi* "	,, *ulmi.*
,, 507	,, 15	,,	" *viridans* "	,, *viridana.*
,, 534	,, 2	,,	" Nordlinge "	,, Nördlinger.
,, 541	footnote		" МАКОРКА "	,, Махорка.
,, 542	line 24	for	" Krassilstchick "	,, Krassilstchik.
,, 568	,, 33	,,	" *Teleonomia* "	,, *Teleonemia.*

ERRATA—*cont.*

Page 584	line 10	for	" *P. minutum* "	read *T. minutum.*
,, 584	,, 14	,,	" *Phytodictus* "	,, *Phytodietus.*
,, 595	,, 5	,,	" *haemadryas* "	,, *hamadryas.*
,, 605	,, 39	,,	" GORIANOV (A.) "	,, GORIAINOV (A.).
,, 636	,, 42	,,	" *salino* "	,, *salina.*
,, 646	,, 5	,,	" no. 16, 1915, p. 63 "	,, no. 16, 1915, 65 pp.
,, 646	,, 31	,,	" is greater than "	,, is not greater than.
,, 646	,, 32	,,	" which increases "	,, and does not increase
,, 648	lines 4 & 16	for	" *Lawana candida* "	,, *Leucaena glauca.*
,, 648	line 5		Delete " *Leucaena glauca.* "	
,, 648	,, 13	,,	" (*Lawana*) "	,, (*Leucaena*).
,, 648	,, 17	,,	" *Leucaena,* "	,, when.
,, 658	,, 29	,,	" *tenthredinarium* "	,, *tenthredinarum.*
,, 675	,, 23	,,	" *Apidencyrtus* "	,, *Aphidencyrtus.*
,, 675	,, 23	,,	" *brittanicus* "	,, *britannicus.*
,, 682	,, 7	,,	" *Scotorytha* "	,, *Scotorythra.*
,, 682	,, 14	,,	" *Phyctaemia* "	,, *Phlyctaenia.*
,, 682	,, 18	,,	" *omniodivorum* "	,, *omiodivorum.*
,, 684	,, 16	,,	" *Euplectius* "	,, *Euplectrus.*
,, 684	,, 24	,,	" Proctutropid "	,, Proctotrupid.
,, 701	,, 29	,,	" *Винорадство* "	,, *Виноградарство.*
,, 705	,, 10	,,	" *Jl. Picentino* "	,, *Il Picentino.*
,, 709	,, 17	,,	" *Ceratoma* "	,, *Cerotoma.*
,, 709	,, 27	,,	" Colias "	,, *Coleus.*
,, 710	,, 20	,,	" *Pencetia viridans* "	,, *Peucetia viridana.*
,, 726	,, 27	,,	" shipping 10,500 tons "	,, employing 10,500 tons of shipping in the trade.
,, 743	,, 1	,,	" *Gypsophylla* "	,, *Gypsophila.*
,, 748	,, 39	,,	" *nigrinectria* "	,, *nigrinectaria.*
,, 754	,, 6	,,	" *Fonscolomba* "	,, *Fonscolombia.*

VOL. III. Ser. A. Part 1.—pp. 1-56. JANUARY, 1915.

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REVIEW

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SERIES A.

VOL. III.] [1915.

PAILLOT (A.). **La Mouche du Chou et la Mouche de l'Oignon.** [The cabbage fly and the onion fly.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xiii, no. 6, June 1914, pp. 89–94, 5 figs.

The cabbage fly, *Chortophila brassicae*, and the onion fly, *Hylemyia antiqua* (some of the many synonyms of which are *Anthomyia ceparum*, *Phorbia ceparum* and *Pegomyia cepetorum*), are both of European origin. *C. brassicae* was recognised as injurious in England in 1840, and its introduction into America dates back to about that time. The onion fly has also been imported into America. The cabbage and onion are their favourite food-plants, but *C. brassicae* also attacks cauliflowers, broccoli, turnips, radishes, and some wild Cruciferous plants. The onion fly is less polyphagous. The life-cycles of the two insects are very similar. According to Slingerland, four generations occur annually, the number depending on latitude and altitude. Usually the adults hibernate, choosing disused sheds, old bark, etc., for the purpose, though some pupae, generally of the second generation, hibernate also. On hatching, the young larva attacks the smallest of the roots and then passes to the principal one, in the surface of which it bores, avoiding the woody central core, though in radishes and turnips the heart may be reached. The larval stage lasts three or four weeks. Pupation takes place near the host-plant and its period varies from two weeks to three months or more. In Europe, the following natural enemies of these flies have been recorded:—The Braconids, *Alysia ruficeps*, *A. manducator*, *Opius procerus*, *Microgaster anthomyiarum*, and the Cynipid, *Figites anthomyiarum*. In 1888, Gillette reported a Cynipid parasite, *Cothonaspis* (*Trybliographa*) sp., which has been found in puparia of the first generation in the United States and Canada. Slingerland mentions a Staphylinid, *Aleochara nitida*, and a *Trombidium* as auxiliary predatory insects. [This paper is incomplete, further issues of the publication not having come to hand from Bordeaux.—Ed.]

(C115) P. 86/57. 1500. 1.15. B.&F.Ltd. Gp. 11/3.

SWAINE (J. M.). **Forest Insect Conditions in British Columbia**—*Domin. Dept. Agric., Div. Entom., Ottawa,* Bull. no. 7, 40 pp., 1 map., 22 figs.

This is a detailed account of the chief damage to timber due to insects in British Columbia. *Pinus ponderosa,* Laws., which occurs in the southern part of the interior, is seriously attacked by *Dendroctonus brevicomis,* Lec., *D. monticolae,* Hopk., and *D. valens,* Lec. [see this *Review,* Ser. A, i, pp. 406–407]. *D. brevicomis* passes the winter in the middle layers of the bark of recently infested trees and the adults appear in large numbers from June onwards. When green trees are attacked the exuding resin forms gum-tubes about the mouths of the entrance-holes, the presence of which indicates infestation before it is otherwise recognizable; yellowing and, later, reddening of the foliage takes place from the middle of August onwards. Before the foliage becomes red, the beetles will already have left the trees. *D. monticolae,* Hopk., is found injuring the same trees as *D. brevicomis;* the broods are found in the inner bark and are exposed when the bark is removed. *D. valens,* Lec., is found in stumps and dying trees of bull-pine (*P. ponderosa*), Engelmann's spruce, and probably other pines and spruces; it is less destructive than the two former species and commonly breeds in the bark of stumps and in the bases of trees dying from other injuries, though it is known to attack and kill apparently healthy trees. It occurs in Canada from the Yukon and British Columbia to Newfoundland and Nova Scotia, throughout the eastern and western United States and the West of Mexico. The number of infested trees in Princeton increased from 10 in 1911 to 139 in 1913, in five isolated areas where counts were made; there appeared to be no effective natural controls present, though bark-beetles are preyed upon by various parasitic and predaceous insects, as well as fungi and insect-feeding birds. When a serious bark-beetle outbreak is indicated, before control measures are adopted, an exact determination of the species concerned should be made by a forest entomologist. The infested trees should be marked for cutting and a rough map made to locate the badly infested parts. If mills are not available for the profitable use of the timber, or if it is impossible to saw all the infested logs within the time limit, *i.e.,* before the 1st of June, a sufficient number should be cut and barked and the bark burned before this date. Infested timber which cannot be used for lumber should be cut and barked or burned in winter. The object should be to destroy the broods in as many of the infested trees as possible, and if over three-fourths of the infested trees of a district can be handled in winter, the outbreak will be checked for several years, and further work on the same lines the following winter should bring it under control. When *D. valens* occurs, the infested stumps should be barked before spring, but if *D. monticolae* only is involved, the removal of the bark from infested trees in winter and spring is sufficient. The following are minor enemies of *P. ponderosa: Ips integer, I. emarginatus, I. interpunctus,* and *I. oregonis.*

Pinus monticola, which occurs from the valley of the R. Columbia to Vancouver Island, is attacked by various bark-beetles, particularly *D. monticolae,* in the interior and on Vancouver Island. There has been an outbreak of this in Vernon District for about eight years, resulting in the destruction of much of the timber, the infested trees

being subsequently injured by CERAMBYCIDAE and BUPRESTIDAE. Control work is similar to that already recommended, except that it is unnecessary to burn the bark. *Pinus murrayana*, which occurs throughout the interior, is attacked by *D. monticolae* and *D. murrayanae*, especially about Sugar Lake, in the Vernon District; outbreaks can be controlled by the measures already recommended.

Pseudotsuga mucronata has not been extensively attacked by insects, but *D. pseudotsugae*, Hopk., appeared to be its most important enemy. The reddish dust ejected from the entrance tunnels and lodged in the bark fissures distinguishes the trunks infested by it. The broods have not in this case necessarily left the tree by the time the foliage has turned red. *D. pseudotsugae* prefers dying bark, which should be burnt between early October and 1st March.

The Sitka spruce, which occurs throughout the coast region and on Vancouver Island, is injured by *D. obesus*, Mannh., and the western spruce gall-louse, *Chermes similis*, but the latter only causes serious injury where the trees are isolated or in isolated groups. The adults of *D. obesus* become active in April, and emerge from the bark and attack fresh trees during May and June or later, the larvae pupating during August and September. Outbreaks may be controlled by the destruction of the broods in winter by any of the methods above enumerated.

Conifers are seriously injured by *Gnathotrichus retusus*, Lec., *G. sulcatus*, Lec., and an undescribed species of the genus *Platypus*, the Pacific Coast timber-beetle, which is most injurious, as its tunnels penetrate deeper than those of any other species, viz., from six to ten inches, and give off lateral branches. These Ambrosia beetles never enter dry, sapless wood, and logs cut in early autumn dry sufficiently to be protected if piled loosely in the open. There is also little injury when the summer cut is immediately placed in water and the winter cut floated before mid-April. Cerambycid and Buprestid beetles do much damage where logs are left out of water for two or more seasons, especially to timber injured by fire. Logs barked within three weeks of cutting will escape damage and, failing this, they should be placed in water within a month from cutting. The paper is accompanied by a map and excellent illustrations.

DAMMERMAN (Dr. K. W.). **Het Vraagstuk der Fruit-vliegen voor Java.** [The fruit-fly question in Java.]—*Meded. v. d. Afdeel. v. Plantenziekten, Dept. van Landbouw, Nijverheid en Handel, Buitenzorg*, no. 8, 1914, 12 pp., 2 pls., 3 figs.

In this paper the enormous damage which might arise to fruit cultivation in Java by the introduction of the Mediterranean fruit-fly is pointed out as a justification for the Ordinance against the importation of Australian fruits quoted below.

The life-history of *Ceratitis capitata* is given at length, and the Java fruits likely to be attacked, are stated to be as follows :—Pineapples, avocado pears, bananas, persimmon, a species of *Eugenia*, coffee, mangoes, grenadillas, papaw, Spanish pepper and tomatoes. *Rioxa* (*Trypeta*) *musae*, Frogg. (the island fruit-fly), is said to be of less consequence than the former and is only met with in Australia and in the New Hebrides. It is not improbable that *R. musae* does

something to complete the damage begun by *C. capitata*. The mango fruit-fly, *Bactrocera ferruginea*, F. [see this *Review*, Ser. A, i, p. 157], is stated to be the most harmful fruit-fly in Java. It not only attacks the mango, but is a serious enemy of Spanish pepper and capsicum. It is also a pest of coffee berries, sapodilla (*Achras sapota*), *Eugenia*, and of all cucurbitaceous plants.

Bactrocera cucurbitae, Coq., (the melon or bitter gourd fruit-fly) is a great pest of all cucurbitaceous fruits, but has not yet been noted as of much importance in Java. It has also been found in tomatoes, French beans, mangoes, and papaws.

Bactrocera caudata, F., is said to attack many kinds of fruits in Java and has long been known, but only now and again does it become a serious pest. The best plan of controlling the attacks of fruit-flies is to collect and destroy all attacked and fallen fruits daily, so that the larvae may have the least possible chance of escaping into the ground to pupate. All such fruit should be burnt, or plunged for 15 minutes into boiling water. It is no use burying it, because it has been found that pupae buried a foot deep were not prevented from developing and the perfect insects contrived to reach the surface. Immersion in water is also useless. Flies have been developed from fruit which has been plunged for 45 hours in sea-water and also from fruit which had been well fumigated with hydrocyanic acid gas. Pupae which have been kept for 3 weeks in a freezing chamber also developed perfect insects. Thorough cultivation of the ground underneath the trees is useful, as this brings the pupae to the surface, where they may dry up or be eaten by birds or other animals. Flooding of the ground under the trees with water will suffocate any pupae or larvae.

Under the Ordinance referred to above, it is absolutely forbidden to import into the Dutch Indies any fresh fruits from Australia without special permission, nor is it permitted to import any material which may have served for the packing of fruit of Australian origin. Should fruit come from Australia, its arrival must be immediately reported, and permission in writing by the proper authority may be given for its landing, but this will be refused unless the fruit is packed in absolutely new cases. Further, it must be accompanied by a certificate from a competent authority at the port of lading that it is free from fruit-fly or other insect pests. Provision is made for the destruction of imported fruit and of all packing material. This Ordinance came into force on 1st February 1914.

MILLER (K.). **Стеблевая совка въ Екатеринославской губерніи въ 1911–1913.** [*Oria musculosa*, Hb., in the government of Ekaterinoslav in 1911–1913.]—**« Защита растеній отъ вредителей.»** [*The protection of plants from pests*, no. 2 (20),] Supplement to the Journal **« Любитель Природы »**, [*Friend of Nature*], *Petrograd*, 1914, 17 pp., 9 figs., 2 sketch maps.

The damage done to crops by *Oria* (*Tapinostola*) *musculosa* during the years 1911–1913 are tabulated in this paper and the results shown on sketch-maps. In 1911 caterpillars were reported only from a few localities of three districts of the government and the damage was

not important, except in one village, where about 270 acres of crops were destroyed. In 1912 a great outbreak occurred in five districts and about 54,000 acres of crops were destroyed, some 74,500 acres more being injured, and the total damage being estimated at nearly £125,000. In 1913, the moth appeared again in five districts, one of which had been free in the previous year. Crops began to be damaged at the end of April and beginning of May, the larvae first attacking the stems and then, from 1st to 28th June, the ears; pupation reached a maximum about 1st July. The first adults appeared in the open on 7th July and disappeared on 7th August. The examination of the weeds showed that they were heavily infested with eggs. No eggs were observed on the stubble of grain crops, nor on weeds other than Graminaceae. Several species of Hymenopterous and Dipterous parasites were noticed but have not yet been identified. Winter as well as summer sown crops were damaged, also *Avena fatua*, L. Barley suffered less than wheat and mostly recovered from its injuries.

As regards remedies, *O. musculosa* belongs to the small group of insect pests which each owner can successfully fight on his own fields whether his neighbours do so or not, being thus very different from *Pyrausta nubilalis*, Hb. The following measures are recommended :—Frequent and repeated mowing of weeds on fallow fields, roadsides, boundary strips, etc.; collection and burning of stubble after the harvest; deep ploughing in autumn with a disk plough. Where such remedies have not been applied, only such crops as are proof against this pest should be sown, viz.:—maize, sunflower, potatoes, millet, and bachza plants.

Work Connected with Insect and Fungoid Pests and their Control.—*Rept. Bot. and Expt. Sta. in Montserrat for 1913–14, Barbados,* 1914, pp. 17–19. [Received 26th November 1914.]

The cotton stainers, *Dysdercus andreae* and *D. delauneyi*, reported to have been prevalent early in 1913, were remarkably scarce early in 1914, and experience shows that they usually occur in July, August or September. A small Arachnid was found to be parasitic upon them, but observations made in December showed that less than 20 per cent. were thus attacked. A weevil, *Euscepes, batatae* attacks the leaves and stems of sweet-potato plants, though little damage is done to the tubers. Sweet-potatoes should not be planted for some time on land that has been badly infested and cuttings should only be taken from healthy tubers.

Gaidoni (A.). **In difesa dei gelsi.** [In defence of the mulberry.] *Udine (Italy)*: Stabilimento Tipografico Friulano, 1914, 80 pp., 8 figs., 2 pls.

This paper records the rapid and successful control of *Aulacaspis pentagona* by *Prospaltella berlesei* in the Province of Udine (Venetia), where the cultivation of the mulberry had suffered very considerable injury up to 1909.

Forti (C.). **Relazione sul concorso antidiaspico indetto dalla Associazione Italiana Confezionatori Seme-Bachi di Milano.** [Report on the competition of controls for *Aulacaspis pentagona* instituted by the Associazione Italiana Confezionatori Seme-Bachi of Milan.] *Bezana-Brianza* (Italy): Tip. Cart. C. Lissoni & Figli, 1914, 20 pp.

The severe damage to mulberries owing to the attacks of *Aulacaspis pentagona* induced the Associazione Italiana Confezionatori Seme-Bachi of Milan to institute a competition for suitable controls. The first prize was awarded to Prof. Berlese in regard to parasitic control by *Prospaltella berlesei*, and a special award was made to Signor G. B. Ambrosoli for an efficient insecticide composed of heavy tar-oil and Diesel motor-oil in equal parts, emulsified in soapy water.

Mori (G.). **La *Cassida vittata* ed i suoi imenotteri parassiti.** [*Cassida vittata* and its hymenopterous parasites.] *Vicenza* (*Italy*): Arti grafiche vicentine, 1914, 27 pp., 8 figs., 3 pls.

In the control of *Cassida vittata*, first reported on sugar-beet in the Province of Pesaro in 1902, though it had apparently existed there for many years previously, insectifuges and insecticides have been found useless. Three endophagous parasites have been discovered and their value as controls is being tested. These Hymenoptera have not yet been identified, but apparently belong to the genera *Tetrastichus*, *Chalcis*, and *Habrocytus*, and rough figures of them are given.

Jarvis (E.). ***Godara comalis*, a cabbage moth, attacking turnips in Queensland.**—*Queensland Agric. Jl., Brisbane*, i, pt. 6, 1914, pp. 427–429, 1 pl.

The Pyralid, *Crocidolomia binotalis*, Zell., (*Godara comalis*) one of the least known cabbage moths, has been observed skeletonizing turnip leaves. This species is sometimes found in association with the cabbage webworm, *Hellula undalis*, a notorious pest, which besides attacking cabbages is destructive to turnips and other cultivated Crucifers. As destruction of the first brood will materially decrease the injury by succeeding generations of moths, prompt measures at the beginning of the season are of the utmost importance. Among the heart leaves of large cabbages the larvae are little harmed by arsenical sprays, which should, however, be effective if applied to young plants or to turnip foliage. This pest is not known to attack cabbage seed-beds, but should it do so, Bordeaux mixture sprayed upon the seedlings in the bed and when planted out, should act as a deterrent. Refuse of cabbages and weeds, especially if of Cruciferous plants, should be burnt, and cultivation between the plants while the pest is the pupal stage, would doubtless destroy many of them.

Kolosov (J. M.). **Матеріалы къ познанію Энтомофауны Урала.** [Materials for the study of the Entomology of the Ural region (I. Hemiptera-Heteroptera).]—**«Записки Уральскаго Общества Любителей Естествознанія.»** [*Bulletin de la Société Ouralienne des Amis des Sciences Naturelles*], *Ekaterinburg*, 1914, xxxiv, no. 6, pp. 81–102.

The insect fauna of the Ural region is by no means well known and the material available for its study is small; the species noted are

either in the Society's Museum or have been nearly all collected by the author within an area of five miles round Ekaterinburg. The Rhynchota mentioned which are of some economic importance include: PENTATOMIDAE:—*Graphosoma italicum*, Müll, *G. lineatum*, *Aelia acuminata*, L., *Carpocoris purpureipennis*, Dg., which is probably only a variety of *C. fuscispinus*; *Eurydema oleracea*, L., common near Ekaterinburg in the middle of May in kitchen gardens and on the leaves of *Leonurus cardiaca*, L. (mother-wort); *Zicrona coerulea*, L.

COREIDAE:—*Syromastes marginatus*, L., found in spring on *Rumex*; *Therapha hyoscyami*, L., on *Hyoscyamus* and sunflowers in August.

LYGAEIDAE:—*Lygaeus equestris*, L.; *Aphanus pini*, which has never been found by the author on pines, but is common in forests, sheltering in bad weather under leaves or fallen pine needles; *Pyrrhocoris apterus*, L., on limes and thistles.

ANTHOCORIDAE:—*Anthocoris memorum*, L., a useful species, in that it sucks the juices of aphids.

CAPSIDAE:—*Adelphocoris lineolatus*, Goeze; *Calocoris chenopodii*, Fll.; *Lygus pratensis*, L., found in early spring on the borders of forests, and in gardens.

TREHERNE (R. C.). **The Strawberry Root-Weevil** (*Otiorrhynchus ovatus* **Linn.**)—*Dominion Dept. Agric., Div. Entom. Ottawa*, Bull. no. 8 1914, 44 pp., 8 figs., 1 chart.

This is a detailed account of *Otiorrhynchus ovatus*, L., and the methods of its control, in the lower Fraser Valley. *O. ovatus*, which has a very wide distribution, is the only strawberry root-feeding insect of economic importance; associated with it are: *O. sulcatus* and occasionally *O. rugifrons*. The life-history is given in detail [see this *Review*, Ser. A, i, pp. 92–94] and a list of its varied food-plants. This weevil destroys the leaves from the margins inwards, and in attacking the roots, devours the epidermis and works its way up the root in a longitudinal or spiral manner. The greatest injury is done in spring, when the larvae attack the main roots, in late summer confining themselves to the smaller roots and root tips. Two definite periods of migration occur during the year, one in early summer and one in autumn; "trap board" experiments to catch the weevils on their migrations showed that the summer migration lasts from mid-June to the end of July; September is believed to be the time of the autumn migration. Against this weevil cultural measures are far more practical than the use of insecticides, none of which repays the trouble involved. Experiments have been conducted to test the efficiency of the following methods and substances as controls and repellents, viz., trap boards, trap lights, tanglefoot barriers, road oil barriers, gasoline torches, arsenical sprayings, soil injections and treatment with carbon bisulphide or powdered potassium cyanide, but it was found that they cannot be recommended in practice. Repellants, such as powdered camphor, sulphur or fresh pyrethrum do not check the migrations of the adult weevil. As regards natural controls, choice of variety, deep cultivation and application of lime and stable manure, previous to the year of planting, followed in June, after the crop is removed, by the destruction of the old leaves and stalks, will be found the most suitable methods for strawberry cultivation in weevil-infested districts. Autumn

planting can only be adopted in very heavily infested areas. Ploughing up exhausted plantations is best done immediately the spring crop is removed, especially on small farms. Whatever the size of the farm, it is advisable to plough not later than the end of June, or very early July, or else leave the ground untouched till autumn. Crop rotation is one of the most efficient methods of controlling the weevil on large farms, and the use of poultry in conjunction with rotation is strongly urged, allowing them free range over the plantation after the summer ploughing. No parasites of *O. ovatus* are known, but the predatory enemies which assist to control the pest include : the adults and larvae of the Carabid, *Amara farcta*, Lec., at least one species of spider, and the common mole.

VASSILIEV (I.). **Клеверная или горбатая толстоножка, истребляющая сѣмена въ головкахъ клевера.** [*Bruchophagus* (*Eurytoma*) *gibbus*, Boh., destroying seeds in clover-heads.]— **« Труды Бюро по Энтомологіи Ученаго Комитета Глав. Управ. З. и З.»** [*Memoirs of the Bureau of Entomology of the Scientific Committee of the Central Board of Land Administration and Agriculture*], *Petrograd*, 1914, xi, no. 3, 7 pp., 6 figs.

The great majority of species of CHALCIDOIDEA are parasites of insects, only a few species being phytophagous ; to the latter belong *Bruchophagus funebris*, How., previously regarded as a parasite of *Bruchus*, but which has been proved by Howard to be a pest of clover, and *Bruchophagus* (*Eurytoma*) *gibbus*, Boh., formerly regarded as a parasite of *Apion*, and only lately described by Kurdjumov as phytophagous. During recent years these pests have often been observed on clover in parts of European Russia. The author describes and figures the imago of *B. gibbus*, which in Russia, according to Kurdjumov and Dobrodjev, has two generations, one in May and the other in August. They winter in their larval stage inside the damaged seeds of clover. The eggs are deposited in the heads of clover and probably also in the ovaries and seeds of other species of Papilionaceae, as G. Mayr has reared them from *Astragalus glyciphyllus* and *Lotus corniculatus*, while *Bruchophagus funebris* also breeds in the seeds of lucerne. The larvae penetrate into the seeds and feed on their contents ; usually one seed is sufficient for the development of one larva, which leaves only an empty shell and pupates inside it. Injury to clover by these pests has already been observed in the governments of Tula, Orel, Vitebsk, Poltava and Kiev, but it is thought that they must also occur in other parts of Russia where clover is grown. According to Portchinsky, the healthy seeds may be separated from those which contain the pest by winnowing ; the remedies recommended by Webster and Folsom against *B. funebris* may be effective against *B. gibbus* also, such as, the collection of the clover heads ; the burning of the clover chaff ; the early mowing of clover for hay, in order to prevent its infection with the eggs of the pests and also to hasten the ripening of the seed and thus protect it from the second generation ; the early autumn ploughing of clover fields in order to bury the fallen seeds ; and the destruction of all wild clover on which these pests breed.

EMELIANOFF (I. V.). **Мѣстныя Опытныя Станціи по Прикладной Энтомологіи въ Соединенныхъ Штатахъ и Канадѣ.** [The local Experimental Stations for Applied Entomology in the United States and Canada.]—Reprint from the *Memoirs of the 1st All-Russian Congress of Workers in Applied Entomology, Kiev*, 1914, 10 pp.

This is a paper read at the first All-Russian Congress of Economic Entomologists, held in Kiev, September 1913, in which the author shortly describes the organisation of local Entomological Institutions in North America. He attributes the splendid activity displayed by these institutions in the United States and Canada, not only to the personal talents of the heads of the various departments, but also to the proper recognition of the requirements and necessities of the countries by the authorities.

WILLIAMS (C. B.). *Kakothrips*, **gen. n., a Division of the Genus** *Frankliniella* **(Thysanoptera).**—*The Entomologist, London*, xlvii, no. 616. September 1914, pp. 247–248, 1 fig.

A short note on the systematic position of *Kakothrips robustus*, Uz., which does considerable damage to peas and beans in England.

RYMER ROBERTS (A. W.). **Collection and Preservation of the Aphidae.** —*The Lancashire and Cheshire Naturalist, Darwen*, vii, no. 78, September 1914, pp. 205–210.

A general account of the life-history of the APHIDIDAE, together with hints on their collection and preservation. Reference is made to the fact that certain species periodically change their food-plants. *A. avenae*, for example, begins the year on apple trees, migrates after two months to wheat or grasses, and returns to the apple in the autumn; *Phorodon humuli* migrates from damsons to hops in Kent; *A. rumicis* migrates from docks and thistles to beans; and many species of the genus *Chermes* alternate between a *Picea* and some other coniferous tree of a different genus.

Microscopical examination is necessary for accurate determination of species, and for this work freshly killed specimens may generally be transferred to clove oil, left there until cleared and then mounted in Canada balsam. Specimens which have been kept for some time in alcohol, should, after dehydration, be transferred to clove oil and mounted in canada balsam. A few species, such as those of the genus *Chermes*, require different treatment, generally fairly good results being obtained by soaking the specimens in a rather dilute solution of acetic acid or caustic potash and then transferring to clove oil.

Loi concernant la Protection des Plantes contre les Insectes nuisibles et les Maladies cryptogamiques. [A law relating to the protection of plants from insect pests and fungus diseases.]—*Le Naturaliste Canadien, Quebec*, xli, no. 2, September 1914, pp. 36–40.

The full text is given of the new law of the Quebec legislature relating to plant protection against insects and fungus diseases. The importation of infested plant-material is prohibited, except under certain conditions. The following insect pests are specified:—*Aspidiotus perniciosus*, Comst., *Euproctis chrysorrhoea*, L., *Lymantria* (*Porthetria*) *dispar*, L., and *Schizoneura lanigera*, Hausm.

Picard (F.). **Les insectes du figuier.** [Insect pests of the fig.]—*Progrès Agric. Vitic., Montpellier*, lxii, no. 36, 6th September 1914, pp. 279–286, 1 pl.

The chief insect enemies of the fig are the beetles *Hypoborus ficus*, *Sinoxylon sexdentatum*, *Hesperophanes cinereus*, *Morimus* (*funereus*) *tristis*, *Haplocnemia* (*Mesosa*) *curculionoides*; the Lepidopteron, *Hemerophila* (*Simaethis*) *nemorana*; and the Coccids, *Ceroplastes rusci* and *Lepidosaphes ulmi* (*Mytilaspis conchiformis*). *Hypoborus ficus* is peculiar to the fig and very common in the South of France, but rarely found in the north. In the south the adult hibernates until the middle or end of March. The female attacks the smaller branches, boring through the bark, and excavates a gallery in the wood in which she oviposits. There is much variation in the galleries of *H. ficus*, which differs in this respect from most other Scolytids, which are recognisable from the character of their burrows. The larva bores a winding gallery under the bark and pupates in the sapwood, the adult emerging after piercing the bark forming the roof of the pupal chamber. There are three generations yearly in the south. The last adults appear in October or November and then hibernate. *H. ficus* does not attack perfectly vigorous branches, as the eggs would be drowned in the abundant sap, but only branches previously weakened by other causes. If, however, infestation is severe, the numerous bore-holes promote evaporation and healthy branches may be attacked. *H. ficus* has many enemies, including the beetles, *Laemophlaeus hypobori* and *Nemosoma elongatum*, besides parasitic Hymenoptera, especially Braconids. Fig trees should only be planted in deep soil, sufficiently well watered to enable them to resist even a prolonged drought. All infested branches and broken twigs should be destroyed. *Sinoxylon sexdentatum* is nearly as abundant as *H. ficus*. The adult Bostrychid enters small branches about two-fifths of an inch in diameter, the point of entry usually being a bud. The female bores parallel to the axis of the branch, and lays her eggs in the gallery. The larvae excavate passages leading off it, the branch being eventually hollowed out and reduced to dust. In the South of France two generations occur annually. This species also attacks the vine, especially in Languedoc, also the olive, mulberry, chestnut, acacia, evergreen oak, etc. *S. sexdentatus* increases less rapidly than *Hypoborus*, and is therefore less injurious. Its coleopterous foes include the Histerid *Teretrius*, and the Clerids, *Denops*, *Tillus* and *Opilo*, besides the Acarid, *Pediculoides ventricosus*, and among the Hymenoptera, the Bethylid *Cephalonomyia formiciformis* and the Braconid *Monolexis lavagnei*. Other less known Bostrychid pests of the fig are *Xylonites retusus* and *X. praeustus*. They both prefer dead wood for oviposition, and have not the economic importance of *S. sexdentatus*. All these Bostrychids may be combated in the same way as *Hypoborus*. *Hesperophanes cinereus* attacks many non-resinous trees, in which its larva bores deep galleries. In the north it is rare, and is found in the poplar, the oak and sometimes in the willow. In the south this Longicorn is more common and shows a preference for the fig, of which the larger branches and trunk are sometimes riddled in all directions. As these galleries are driven through the central zone of the wood and not through the functional portions, the tree

often resists for years, but the branches are weakened and eventually break. The adults, which are nocturnal, also cause a loss of sap through boring exit holes, and *H. cinereus* is therefore very injurious if present in numbers, as is the case in old fig trees. Cutting and burning infested branches is the only method of control, and very old trees are best destroyed entirely. It is possible that *Iphiaulax flavator*, the Braconid parasite of the oak *Hesperophanes*, *H. pallidus*, also attacks *H. cinereus*. In the extreme south of France another species, *H. sericeus*, is found on the fig. *Morimus funereus* (*tristis*) is the largest Longicorn found on the fig, and is a southern species, the adult being nocturnal. The larva lives indifferently in the cypress and the fig. It is only slightly injurious, the injury being similar to that of *Hesperophanes*, but much less severe. The larva of *Haplocnemia* (*Mesosa*) *curculionoïdes* is found in the poplar, lime, walnut, elm, cherry, and especially in the fig. Branches of medium thickness are mostly attacked. Though found throughout France, it is most common in the south, but this Longicorn is not a serious pest. *Hemerophila nemorana* has only lately been regarded as an enemy of the fig. Another species, *H. pariana*, is known in France as a pest of apple and pear trees, etc., but *H. nemorana* is peculiar to the fig. The caterpillars feed on the underside of the leaves, often leaving the upper epidermis intact. They also attack the fruits and do more harm to them than to the foliage. Pupation takes place in a white cocoon placed on the veins of the leaf. Two generations occur annually, and the second generation is most to be feared, the autumn figs being destroyed in large quantities, considerable loss having been sustained in the past few years in the Var and in Hérault. The insect is found throughout South Europe, in Asia Minor, North Africa, the Canaries and Madeira. Many Hymenoptera, especially Ichneumons, parasitise *H. nemorana*. No real control measures have been attempted as yet, though this pest takes a large toll of the French fig crop. *Ceroplastes rusci* is not peculiar to the fig, but in North Africa, Provence, Italy, etc., it infests this tree to such an extent as to endanger the crop. A period of infestation is followed by one during which only a few Coccids are to be found on the fig; the multiplication of natural enemies accounts for this. They include the Coccinellid, *Chilocorus bipustulatus*, the Chalcid, *Scutellista cyanea*, and the Noctuid, *Eublemma* (*Thalpochares*) *scitula*. Trabut states that *C. bipustulatus* produces a bitter flavour in the fruit. *E. scitula* feeds on the Coccids exclusively, and does not eat the leaves. Where natural control does not suffice, spraying with the alkaline polysulphides usual in Coccid control is recommended. Another scale found on the fig is *Lepidosaphes ulmi* (*Mytilaspis conchiformis*). It does great damage in North Africa, and is found on the branches, not on the leaves. Among other pests, *Psylla ficus* may be mentioned. The most celebrated insect found on the fig is the Chalcid, *Blastophaga psenes*, but its action is beneficial, as it is an agent in caprification.

COOK (A. J.). **A foe to guard against.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iii, no. 9, September 1914, p. 372.

County horticultural commissioners are urged to watch for the western rose chafer, *Macrodactylus uniformis*, which apparently is present in Arizona. It is considered that this Cetoniid beetle, if once introduced into California, would become a very formidable pest.

Wolcott (G. N.). **The Cotton Boll-Weevil in Cuba.**—*Proc. Ent. Soc. of Washington, Washington, D.C.*, xvi, no. 3, September 1914, pp. 120–122.

A chronological record of the distribution of *Anthonomus grandis* in Cuba states that the cotton boll-weevil was first recorded there in 1871. From 1900 cotton-cultivation spread widely, until a plague of boll-weevils entirely destroyed the crop, and no cotton was planted except for a few small plots at the Estación Agronómica, Santiago de las Vegas. Wild tree-cotton plants remained to furnish the boll-weevil with a food supply, but later the large cotton trees in Western Cuba were destroyed by a series of hurricanes. From 1908 to May 1912, no boll-weevils have been found on the cotton at the Estración Agronómica. At Artemisa, cotton entirely free from the boll-weevil has been cultivated from 1909 to 1912, the grower attributing his success largely to the fact that the cotton was planted towards the end of the rainy season in October or November, and harvested in the spring, before the rains began. No boll-weevils have been discovered to date, except near Cienfuegos in Central Chapana, where, in February 1914, three cotton plants were found to be attacked. Cotton is not grown commercially there, and no other plants in the neighbourhood seemed to be injured. Eight adult boll-weevils were collected, six of which were destroyed a few days later by the ant, *Solenopsis geminata*.

In March 1914, the author visited Kingston, Jamaica, and reported that no boll-weevils were to be found on any of the varieties of cotton grown there.

D'Ambrosio (G.). **Invasione di bruchi.** [An outbreak of caterpillars.] —*Boll. Catt. Amb. d'Agric. Brindisi*, viii, no. 9, September 1914, pp. 70–71.

An outbreak of caterpillars is reported from the district around Brindisi, those of *Pieris brassicae* and *P. rapae* being particularly numerous. The flea-beetle, *Haltica oleracea*, was also abundant. The ground should be sprinkled with lime, ashes or sulphur, and the insects collected. Turkeys will greedily devour them, especially if let loose early in the morning. Lead arsenate is very efficient, but hardly advisable for kitchen-garden crops.

Lewton-Brain (L.). **Agriculture in Malay in 1913.**—*Dept. Agric., Fed. Malay States, Kuala Lumpur*, Bull. no. 20, September 1914, pp. 1–45, 7 tables.

This bulletin is reprinted from the annual report of the Director of Agriculture for 1913, and contains the following notes on insect pests :—*Xyleborus parvulus*, closely related to *X. fornicatus*, Eich., of Ceylon, bores into the trunk or branches of rubber trees, usually into those which have some fungus disease, the fork of a tree or the end of a badly pruned branch being a favourite point of attack. Diseased trees should be cut down and burnt ; tar, or if this is unsuccessful, lead arsenate should be applied to healthy trees attacked by *X. parvulus*. The Lepidopteron, *Hidari irava*, did some damage to coconuts, but was kept under by the attacks of a small hymenopterous parasite.

In some parts coconuts were also attacked by bag-worms, *Thyridopteryx ephemeraeformis*,* which were also kept under by parasitic insects. *Brachartona catoxantha* caused some damage in Krian. Successful control measures have been carried out against the locust [see this *Review* Ser. A, ii, pp. 479, 565, 606], which has so far only been identified as a species of *Locusta* (*Pachytylus*).

EWING (H. E.). **The Geographical Distribution of Our Common Red Spider,** *Tetranychus telarius*, **Linn.**—*Jl. Entom. & Zool., Claremont, Cal.*, vi, no. 3, September 1914, pp. 121–132, 1 fig.

The common red spider, *Tetranychus telarius*, L., is nearly world-wide in its distribution. In Europe, where it has been longest known, it is a serious pest, and is generally distributed, except in the northern part of Russia and in the Scandinavian Peninsula. In North America it is found from Ontario to Texas and from British Columbia to Southern California. It also is known from South America, Hawaii, South Africa and Australia. There appear to be no records of the mite occurring in India or in the Philippines.

The chief factors affecting the distribution of *T. telarius*, L., are those of climate and of host plants. Wherever the mean daily temperature falls below about 50° F. this mite will not reproduce, but sometimes under these circumstances it hibernates. Unless there is a summer mean considerably above 50° F., this species is not likely to be present. *T. telarius* has been reported up to elevations of from 7,000 to 8,000 feet. In the hottest part of the summer in Southern California it is said not to thrive so well as in lower temperatures, nor as well in a wet climate as in a dry one. Yet neither an excessively wet nor an excessively dry climate will prohibit its development. The presence or absence of favourite host plants influences distribution, and, being specially adapted to greenhouse plants, it is found wherever plants are grown under glass with the aid of artificial heat.

KING (G. B.). **The eleventh** *Kermes* **(Coccidae) from California.**—*Jl. Entom. & Zool., Claremont, Cal.*, vi, no. 3, September, 1914, p. 133, 1 fig.

Kermes mirabilis, sp. n., found on *Quercus* sp., at Mountain View, California, is described. It is allied to *Kermes galliformis*, etc.

P. S. **Хроника** [Chronicles].—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, September 1914, no. 9, pp. 855 & 858.

Experiments with the American system of high pressure spraying against *Cydia pomonella* were conducted in 1913 by the Entomological Station of Turkestan, full results of which will be shortly published. They have proved the many advantages of djipsin over Paris green; there was no scorching, lime was not required, and the material did not settle at the bottom of the sprayer or container. An Aphid which attacked varieties of willow in Tashkent has been identified by Plotnikov as *Lachnus viminalis*.

* [There has probably been an error in the identification of this Psychid moth, for the species mentioned is confined to North America.—ED.]

C. J. G. **Insect Pests of Carnations.**—*Gardeners' Chronicle, London,* lvi, no. 1445, 5th September 1914, p. 172.

Tetranychus bimaculatus and the onion thrips, *Thrips tabaci*, are described and recorded as carnation pests. Continued spraying with water is recommended for the former; the thrips are most active on the outside of the buds early in the morning, when it is recommended that a spray consisting of a paste made from 6–8 pounds of cheap flour to 100 gallons of water be used: nicotine extract has also been used successfully. *Blanjulus guttulatus* eats through the roots of carnations. A dressing of lime on soil infested with this and other millipedes is a sure remedy, and the dusting of soot and lime round each root before planting has been tried successfully as a means of preventing their attacks. Molinas' experiment with potassium sulpho-carbonate solution [see this *Review*, Ser. A, ii, pp. 362–363] is fully described.

The acrobat ant.—*Agric. News, Barbados,* xiii, no. 323, 12th September 1914, p. 298.

The acrobat ant, a small black species of *Cremastogaster*, is common in Barbados and probably occurs in other islands. It does not often invade houses, but is to be found on all out-buildings, palings, trees, roots and in the ground. Its nests occur under bits of bark on tree trunks or where pieces of board have been nailed together. It lives inside the stems and branches of dead plants, and even in living wood. It almost always occurs on plants infested with scales, mealy-bug and aphids and has also been noticed near injuries which cause the exudation of sap. It is injurious to plants because it prevents wounds in the bark from healing over. In addition to injuring trees, it appears to hasten the decay of timber. It is likely to be a difficult insect to control, for it is not possible to treat the nests satisfactorily. In one case, thousands of nests were destroyed by kerosene, but so many were overlooked that the numbers were not much reduced. Poison baits do not appear to attract these insects.

Urich (F. W.). **Entomologist's Report.**—*Minutes of Meeting of the Trinidad Bd. Agric.*, no. 7, 18th September 1914, p. 37.

Since the last report [see this *Review*, Ser. A, ii, p. 646] froghoppers have not been so numerous as in the same months of former years. The green muscardine fungus is working well. The coconut scale, *Aspidiotus destructor*, has been completely wiped out by the predaceous beetle, *Cryptognatha nodiceps*, Mshl. When the beetle had almost done its work the scales were attacked by a small hymenopterous parasite, which killed many of the pupae. Cacao beetles are still in evidence in all stages, as lack of co-operation in control permits re-infection of cleansed areas from adjoining infested ones.

Jatchevsky (A.). **Борьба съ майскимъ хрущемъ.** [The fight against *Melolontha melolontha*.]—**«Хуторянинъ.»** [*Chutorianin*], *Poltava* no. 35, 10th September 1914, pp. 993–994.

In a letter to the Editor of the above journal the author refers to the answer given by D. Borodin as to fighting *Melolontha* [see this *Review*, Ser. A, ii, p. 542] by means of the fungus *Botrytis tenella*, and

states that cultivations of this fungus, as well as of other fungi attacking insects, can be obtained from the Bureau of Mycology and Phytopathology of the Scientific Committee of the Central Board of Land Administration and Agriculture. He disputes the statement by Borodin that this method is no longer applied as a remedy against *Melolontha*; it is frequently used in France, although equally good results are not always obtainable. The Bureau also experiments with various other fungi as possible enemies of insects.

Fabrikant (A. O.). **Къ вопросу о борьбѣ со стеблевой совкой.** [On the question of fighting *Oria musculosa*, Hb.] – **«Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd*, no. 35 (47), 12th September 1914, pp. 1137–1138.

The author reviews the work of a special conference on controlling *Oria* (*Tapinostola*) *musculosa*, which was convoked by the District Zemstvo of Petrograd in July 1914. In South Russia *O. musculosa* is one of the most dangerous pests, and so far as the government of Ekaterinoslav is concerned, the damage caused by these insects in 1912 amounted to £265,000, as many as 54,000 acres of crops being totally destroyed and 67,000 damaged in only five districts of the government. Some of the remedies suggested proved to be unworkable. Thus the late sowing of summer crops, which may be very effective against *O. musculosa*, the larvae of which appear early in spring, cannot be undertaken, as it may risk the loss of the whole harvest. The burning of stubble, harrowing, deep ploughing, regular rotation of crops, and the destruction of weeds were also recommended. The necessity of applying more scientific methods of agriculture was urged on the population, the chief reason of the enormous multiplication of the pests being the primitive methods of the local peasants, their neglect of the use of ploughs and of autumn ploughing, and their custom of sowing in soil prepared only by means of "bukkers" (an antiquated implement which only scratches the surface).

Van Dyke (E. C.). **The Great Basin tent-caterpillar in California (*Malacosoma fragilis*, Stretch).**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iii, no. 9, September 1914, pp. 351–355, 3 figs.

Five of the nine species and varieties of *Malacosoma* which occur in North America are found in California. The commonest is *M. californica*, Pack., which normally feeds on live oaks and apple trees, *M. constricta*, Stretch, found on black and white oaks, and *M. pluvialis*, Dyar, which is very injurious to apple trees as well as to the alder, its native food-plant. *M. fragilis*, Stretch, ranges throughout the northern portion of the Great Basin, extending from the Rocky Mountains to the Cascades and Sierra Nevadas, and, according to Dyar, feeds on the wild gooseberry and wild rose. During the summer of 1914 enormous numbers of the caterpillars completely defoliated the extensive bush areas to the south, east and north-east of Mount Shasta, the bush presenting a brown and withered appearance. The bush here is chiefly composed of two species—*Ceanothus velutinus*, Dougl., and the so-called snow-bush, *C. cordulatus*, Kell., which seemed to be the favourite food-plants. The caterpillars appeared about the first of June and migration of full-grown individuals began about the

beginning of July ; these were soon joined by hosts of undeveloped specimens which had eaten up all the available food in the neighbourhood and were seeking other feeding grounds. They were to be found everywhere and seemed to have a preference for travelling along the railways, causing much delay and expense, and were even a source of great danger. The railway authorities at McCloud at first stationed men with brooms on the fronts of the engines ; this was fairly successful at first, but later was less so, as many of the caterpillars were inevitably crushed in the process. Cresol sprinkled along the sides of the road bed only retarded the migrating hosts for a few moments. Ditches dug about camps kept out the pests, but could not, owing to expense, be used by the railroad. At last an attachment was devised whereby steam could be conducted from the engine through tubes and blown forward along the track, ahead of the train. This was very successful because it cleared the rails without crushing the caterpillars and at the same time stunned or killed them so that they could not return.

Though primarily feeding on the two species of *Ceanothus*, the caterpillars, when once they had consumed all their normal food, attacked almost anything, though no coniferous trees seem to have been touched. By the second week of July the caterpillars were commencing to spin their cocoons ; from cocoons collected in the bush, moths emerged between the 24th and 30th July. Many of the caterpillars had been parasitised by various Tachinids which could be seen in infested areas, but they made but little impression on the numbers. From thirty-eight cocoons collected twenty moths and three Ichneumonids were reared, and several Tachinid puparia obtained. The predaceous beetles, *Calosoma semilaeva*, Lec., and *C. luxatum*, Say, var. *zimmermanni*, Lec., were fairly numerous in the field and a Sphegid and a large species of *Psammophila* were observed carrying off full-grown caterpillars. Neither birds not ants attacked the living caterpillars, although many dead specimens were carried off by the latter.

Insect Notes.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iii, no. 9, September 1914, p. 378.

The Sphingid, *Pholus achemon*. has been doing considerable damage to grapes, entire defoliation of about 40 acres and serious damage over a much larger area being reported. A number of the Braconid, *Apanteles glomeratus*, has been introduced into cabbage fields infested with the caterpillars of *Pieris rapae*. Numerous adults of the California grape-root worm, *Adoxus obscurus*, L., were found feeding on *Saxifraga feltata*, which occurs very abundantly along streams in the Sierra Nevadas. Adults of the large wood-boring beetle, *Prionus californicus*, have been collected, and the pine scales, *Aspidiotus californica* and *Chionaspis pinifoliae*, were numerous on pines. The mealy plum louse, *Hyalopterus arundinis*, has been found feeding on reed grass, *Phragmites communis*, this being the first record of any food-plant other than the plum in California. *H. arundinis* has been known to leave plum and prune trees as soon as it becomes winged, but whither it migrated was unknown. In Colorado, Gillette discovered its habit of going from the plum to the reed grass some years ago, but as this grass is not plentiful in California it would appear that this Aphid must also have some other alternate host.

Gardner (A. K.) & Sweetser (H. P.). **Strawberry Culture under Maine Conditions.**—*Qtrly. Bull. Maine Dept. Agric., Augusta*, xiii, no. 3, September 1914, 27 pp., 6 plates, 7 figs.

The larvae of *Lachnosterna* attack the roots of strawberries at the end of June or beginning of July and these should not be planted on freshly turned soil, since the eggs are usually deposited in turf. *Anthonomus signatus* deposits its eggs in the blossom, and feeds largely on the pollen. A Gelechiid caterpillar *Aristotelia* sp., bores into the crown. Rotation helps to prevent its depredations, but insecticides are ineffective. Few serious infestations appear in a field where a rotation is practised, followed by the introduction of new plants.

Ehrhorn (E. M.). ***Pseudococcus* Species Found on Sugar-Cane in Hawaii.**—*Proc. Hawaiian Entom. Soc., Honolulu*, iii, no. 1, September 1914, pp. 1–3.

At present three species of mealy-bugs attack sugar-cane in Hawaii. The large pink species determined by Kotinsky as *Pseudococus calceolariae*, Mask., is considered by the author to be *P. sacchari*, Ckll., and that identified as *P. sacchari*, Ckll., to be *P. sacchrifolii*, Green, or a variety of it. The third species was recently found by Swezey and the author and identified as *P. bromeliae*, Bouch., although it would also fit the description of *P. ananassae*, Kuw.

It would seem to be clear that *P. calceolariae* does not occur in the Hawaiian Islands.

Pierce (W. D.). **Descriptions of Two New Species of Strepsiptera parasitic on Sugar-Cane Insects.** *Proc. Entom. Soc. Washington, Washington, D.C.*, xvi, no. 3, September 1914, pp. 126–129.

Two new species of Halctophagidae, parasitic on sugar-cane leafhoppers, are described: *Stenocranophilus quadratus*, gen. et sp. n., which was obtained in large numbers in October 1912 from sugar-cane at Rio Piedras, Porto Rico, a parasite of *Stenocranus saccharivorus*, Westw.; and *Pyrilloxenos compactus*, gen. et sp. n., collected in 1907, 1913 and 1914 from Pusa, Behar, India, a parasite of the sugar-cane fly of India, *Pyrilla* sp.

Walton (W. R.). **A New Tachinid Parasite of *Diapheromera femorata*, Say.** *Proc. Entom. Soc. Washington, Washington, D.C.*, xvi, no. 3, September 1914, pp. 129–132, 1 pl.

A third species of Tachinid, *Euhallidaya severinii*, sp. n., which has been found to be parasitic on the Phasmidae, is described. It is closely related to *Hallidaya*, Egger, and it is pointed out that the three known Tachinid parasites of the Phasmidae are generically widely separated.

Rohwer (S. A.). **Description of Two Parasitic Hymenoptera.**—*Proc. Entom. Soc. Washington, Washington, D.C.*, xvi, no. 3, September 1914, pp. 141–142.

Sympherta mnemonicae, sp. n., parasitic on *Mnemonica auricyanea*, and *Podogaster evetrivorus*, sp. n., from New Mexico, a parasite of *Evetria* sp., attacking *Pinus ponderosa*, are described.

Gibson (A.). **Army-Worm Outbreak of 1914.**—*Census and Statistics Mthly., Ottawa*, vii, no. 73, September 1914, pp. 232–234.

A severe outbreak of the army-worm, *Cirphis* (*Heliophila*) *unipuncta*, occurred in Ontario in July and August, 1914, the pest being reported from 37 counties and districts. In many of these the damage was unimportant, and it was fortunate that at the time many fields of oats and barley were approaching maturity, largely owing to the dry season. The crops attacked were oats, barley, corn, hay, spring wheat, lucerne, clover, peas, mangolds, beets, turnips and millet. In the counties of Oxford, Brant and Elgin, where the army-worms were most abundant, whole fields were devastated. The total loss, direct and indirect, is believed to exceed £50,000 in Ontario alone, while £10,000 may be taken as a low estimate of the crop damage in Quebec, Nova Scotia and New Brunswick. No caterpillars of the hibernating brood of army-worm have been detected, even in the worst infested districts, in spite of special search. The larvae of the injurious brood were heavily parasitised, particularly by the Tachinid, *Winthemia* sp., and a bacterial disease destroyed great numbers; predaceous beetles were also found feeding on them. In Canada there are two annual broods, the moths appearing in June and again in August and September. This last generation lays eggs which hatch in ten to twelve days. The young caterpillars winter beneath tufts of grass and other low herbage and in the spring complete their growth, feeding chiefly on grasses. The second brood of caterpillars occurs in July and early August and it is this brood which in almost every instance has injured crops in Canada.

The chief method of control is to plough furrows as deeply as possible or dig trenches in advance of the line of march. These trenches should be at least ten inches deep, and in them post holes at least one foot, preferably two feet, deep should be dug every fifteen feet. The side nearest to the crop to be protected should be straight and vertical. Owing to the dry weather in 1914, it was found advisable, in clay land, to rake the vertical side before it had time to dry. The soil thus crumbled as it dried and fell off with the army-worms which attempted to climb it. Such raking is important, otherwise the soil becomes baked like cement and the caterpillars will crawl up it easily. If they fail to do this, they wander along the trench until they reach a post hole, into which they fall. They may then be destroyed, either by crushing or by pouring coal oil into the hole. Other measures consist in spraying Paris green or lead arsenate on to the edges of crops to which the caterpillars have gained access. Poisoned bran, as used against ordinary cut-worms, has proved of value in the case of light infestations and many crops in Nova Scotia were saved by this means.

Forest Investigations in British Columbia.—*Agric. Gaz. Canada, Ottawa*, i, no. 9, September 1914, pp. 698–699.

Hemlock in Stanley Park, Vancouver, has been much damaged by *Therina* caterpillars and woolly aphids. The dying and recently killed trees serve as breeding places for injurious insects, especially for the western hemlock bark-beetle, and should be removed during autumn and winter, the denuded areas being re-forested with Douglas fir. This policy should be continued as the hemlock gradually dies out. Yellow and black pines, in the Okanagan district, are becoming increasingly infested with bark-beetles, and the problem demands immediate attention. Larches, along the Anow Lakes, are much infested with a fungus and, if precautions are not taken, bark-beetles will attack the weakened trees.

Vassiliev (Eug. M.). **О мѣрахъ борьбы съ озимыми совками и озимыми червями.** [On the methods of fighting the imago and caterpillars of *Agrotis*.]—**«Вѣстникъ Сахарной Промышленности.»** [*Herald of the Sugar Industry*], *Kiev*, no. 34, 6th September 1914, pp. 191–195.

This article is a statement on behalf of the Myco-Entomological Experimental Station of the All- Russian Society of Sugar Refiners in Smiela by the author as to the reported appearance in the beet-growing region of Russia of various cutworms, chiefly *Euxoa segetum*, Schiff., and *Feltia exclamationis*, L. In this part of Russia *E. segetum* has two generations yearly: in the first half of June and in the first half of August.

Against the imagines, catching the insects on fermenting molasses, and hand collection between 9.30 and 10.30 p.m. on the ears of grain along the borders of rye fields, adjoining land overgrown with weeds, are recommended. This is not practicable against the second generation, as at the time of their appearance the harvest is already over. They are particularly numerous after a night of rain and the same phenomenon is noticed in the laboratory, where, after the washing of the floors, the insects emerge in large numbers. According to Rossikov, hand collection is preferable to catching on molasses in cold or wet weather, but in the opinion of the author, this may be true so far as North Russia is concerned, but in South Russia the rains are mostly of short duration and the rain-water which gets into the troughs evaporates quickly.

Against the eggs of this pest the method of "occupied fallow land," as recommended by Rossikov [see this *Review*, Ser. A, ii, pp. 314–316] is advocated, and this remedy also deserves attention with regard to beet plantations; it will affect directly the first generation of the pests and indirectly, the second one, and its influence will be specially great in rainy years, when fallow and other fields become rapidly overgrown with weeds. The destruction of the eggs and larvae is assisted by spraying the grasses mown down in the fallow fields, boundary strips, etc., as well as the crops, with kerosene, caustic lime, a five per cent. solution of barium chloride or one-half per cent. Paris green. Other measures include: trenches about seven inches deep, with pits at intervals, in order to isolate the attacked spots, the trapped caterpillars

being afterwards destroyed with kerosene ; traps of leaves of cabbage-beets or sowthistles (*Sonchus*), underneath which the caterpillars hide during the daytime ; hand collection of the caterpillars ; protection of rooks, which destroy them ; the use of poisoned bran baits, as recommended by Kurdjumov, consisting of 1 lb. of Paris green or white arsenic to 25 lb. of bran, mixed with one gallon of water to which two quarts of molasses have been added. The bait must be put into the fields late in the evening so as to prevent it from getting dry before the caterpillars begin feeding ; about one tablespoonful of the bait at intervals of three feet apart is sufficient. Against the pupae, cultivation between the beets in July and the re-ploughing in spring of those parts of the winter fields which have been damaged in autumn, are recommended.

Romanovsky-Romanko (V.). **Значеніе табачной пыли въ садоводствѣ и огородничествѣ.** [The importance of Tobacco Dust in Fruit-growing and Market-Gardening.]—**«Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd*, no. 36 (48), 19th September 1914, pp. 1162–1163.

The author calls attention to the enormous quantities of tobacco dust which are obtained yearly in the tobacco industry and which in most cases are treated as waste and destroyed. The high transport rate of the Russian railways for this article is one of the reasons which prevents the growth of its application in Agriculture as a manure and as a very effective remedy against many pests. He refers to the work of T. T. Kaike, who, in 1912, published the good results obtained by fumigation with tobacco dust against *Psylla mali* in the orchards of the government of Orel in 1910–1912. Tobacco dust can also be used as a decoction for spraying, the effectiveness of which has been demonstrated by Glasenapp [see this *Review*, Ser. A. i, pp. 370–371] against *Psylla mali*, *Aphis pomi*, *Cheimatobia brumata* and other pests. The author used tobacco dust with success against *Eriocampa adumbrata*, which appeared in 1910 and 1911, in August, on the leaves of young cherry trees. The tobacco was applied as dust because the larvae of *E. adumbrata* are covered with slime which may protect them from liquid insecticides. The necessity of facilitating the sale of tobacco dust free of duty, for which purpose it may be rendered useless to smokers by the addition of kerosene or naphtha, is strongly urged.

Rogozin (S.). **Примѣненіе мышьяка въ борьбѣ съ „яблонной молью“.** [The application of arsenic in the fight against *Hyponomeuta malinellus*.]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-growing and Market-gardening*], *Petrograd*, no. 36, 20th September 1914, pp. 1093–1095.

In the spring of 1914 an outbreak of *Hyponomeuta malinellus*, unparalleled for the last 20 years, occurred along the Volga and Kama, and at the beginning of June the orchards on the banks of both these rivers, from Perm and Nijni-Novgorod as far as Saratov, turned quite yellow. In the orchards in Simbirsk it appeared that sprayings with

Paris green in normal doses had no effect at all, while favourable results were obtained by sprayings with white arsenic, without any addition of lime, soda, salammoniac, etc., of a strength of 1 lb. of arsenic in 270 gallons or more of water. The same result was also obtained by others in Simbirsk, as well as in Samara. In the latter place, some orchards after having been unsuccessfully sprayed eight times with Paris green, were only saved when the strength of the solution was increased to 1 lb. of green in 54 gallons of water. The failure of the Paris green is attributed to the rains, which occurred after the blossoming of apple trees was over and continued till the middle of June, the insecticide being washed from the trees. It is maintained that a mixture of arsenic and lime is less easily washed off in this way, owing to its lower specific gravity. This composition is also quite harmless to trees, even when used at a strength of 1 lb. to 162 gallons of water, which is the proportion recommended; even a proportion of 1 lb. to 81 gallons of water caused no scorching of the leaves. It also mixes more uniformly with water and is about one-eighth as costly as Paris green with lime of a corresponding quality. No foreign substances are found in it and it is less poisonous to man than Paris green.

The author says that his own orchards in Simbirsk, which he has sprayed with this insecticide for the last 15 years, were quite healthy, while all the surrounding ones were more or less seriously damaged.

BALABANOV (M.). **Зелень или мышьякъ?** [(Paris) green or arsenic?] —**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-growing and Market-Gardening*], *Petrograd*, no. 36, 20th September 1914, pp. 1095–1096.

The author refers to the foregoing article by Rogozin, and while admitting the usefulness of arsenic in the fight against caterpillars and also its cheapness as compared with Paris green, disputes his statement that Paris green in a normal proportion (¼ lb. in about 43 gallons of water) is ineffective. In his opinion, this statement requires further investigation before it can be accepted as conclusive, and he points out that the quality of the Paris green used in the instances recorded by Rogozin, as well as the method of the preparation of the insecticide, are not stated, and that in many cases erroneous conclusions as to the effect of Paris green are arrived at owing to the fact that the caterpillars after having been poisoned with Paris green, remain alive for three to four days, but do not take any more food. He has used Paris green for the last 20 years in fighting *Hyponomeuta malinellus* and other caterpillars, such as those of *Aporia crataegi*, *Lymantria dispar*, etc., in orchards of the governments of Kursk and Charkov, with excellent results, and that there is no reason why the same results should not be obtained in the Volga and elsewhere.

BALLOU (H. A.). **Report on the prevalence of some Pests and Diseases in the West Indies during 1913.**—*West Ind. Bull., Barbados*, xiv, no. 3, 21st September 1914, pp. 198–220.

This report is almost identical with that of the previous year [see this *Review*, Ser. A, ii, pp. 86–88], a few additional insect pests being

referred to. Cotton is locally attacked by a grey weevil, *Lachnopus*, in St. Kitts, while *Lachnopus valgus* occurs in Anguilla, *L. curvipes* in Tortola, and another species, as yet unidentified, in Antigua, St. Kitts and Nevis. In St. Lucia horse beans were severely injured by a caterpillar believed to be the same as that which attacks the sweet potato, *Protoparce cingulata*, and which is preyed upon by *Polistes annulatus*. Ground-nuts were attacked by the green bug, *Edessa meditabunda*, in St. Vincent and by leaf-eating caterpillars in Antigua and Nevis. Scale-insects were present everywhere on citrus trees in Grenada, where the fungus, *Sphaerostilbe coccophila*, proved valuable in 1913 and promised well as a control. The orange moth (which has not yet been identified) was prevalent in Dominica and the object of special investigation.

The root-borer of sugar-cane, which occurs sparingly in St. Lucia is probably the larva of *Diaprepes abbreviatus*, while that found in St. Kitts is *Exophthalmus esuriens*. *Pseudococcus calceolariae* is generally distributed on sugar-cane in Antigua. The Jack Spaniard wasp (*Polistes*) continued to be a very useful enemy of the cotton worm, *A. argillacea*, in St. Kitts. In Nevis, the parasite of the cotton worm was observed in one or two places only this year. The worm did a fair amount of damage to some fields, but this was probably due rather to bad management in the use of poison than to severity of attack.

WATSON (J. R.). **Whitefly control, 1914.**—*Florida Agric. Expt. Sta., Gainesville*, Bull. 123, September 1914, 24 pp., 5 figs.

The drought in 1914 caused the autumn brood of whiteflies to be the largest that Florida has experienced for several years. The four species which may infest citrus trees in sufficient numbers to require control are the common citrus whitefly, *Aleurodes citri*, the cloudy-winged whitefly, *A. nubifera*, the woolly whitefly, *A. howardi*, and the waxy or bay whitefly, *Paraleurodes perseae*, the first two being the more important. They do a considerable amount of damage [see this *Review*, Ser. A, i, pp. 186–188], and a heavy infestation is apt to be followed by an increase of the purple scale, especially in the case of the woolly whitefly. The purple scales collect under the wool of the whitefly, because their crawling young avoid light and the wool forms a retreat where they are partially protected from their insect enemies, such as the twice-stabbed lady-beetle [*Chilocorus bivulnerus*, Muls.], and also from the spores of parasitic fungi. A flourishing colony of scales is thus established. In the case of the common citrus whitefly, the sooty mould affords somewhat similar conditions. Another factor that doubtless contributes to this increase of scales is that a badly infested tree being less vigorous and casting less shade, does not furnish as good conditions of humidity for the growth of the parasitic fungi as a healthy one. The female whitefly lays a hundred or more eggs in the course of her life of a week or 10 days. Most of these hatch during summer in ten or twelve days. The larvae crawl about for a few hours until they find a suitable spot to insert their proboscis, after which they remain stationary until the adult stage is reached. In order to avoid too strong a light they nearly always

settle on the underside of the leaves. For the same reason they prefer the north side of trees. This is particularly marked on small, and hence well-lighted trees. Insects are not important natural enemies of the whitefly; the twice-stabbed lady-beetle destroys some of the crawling larvae and occasionally older ones. The larvae of SYRPHIDAE and CHRYSOPIDAE also destroy many crawlers and a species of thrips eats the eggs. The most efficient work is performed by some parasitic fungi [see this *Review*, Ser. A, ii, p. 129], especially by the brown fungus, *Aegerita webberi*, because it does not depend upon the dispersal of the spores to reach other larvae on the leaf. Its thread-like mycelium radiates from each dead larva far over the surface of the leaf and unless checked by cold or drought is sure to infect any other whitefly larvae present. These hyphae often extend down the leaf-stalk, over the twig and up the stalks of other leaves. *A. webberi* seldom appears before August, but often continues to grow well into November if the weather is sufficiently humid. The red fungus, *Aschersonia aleurodis*, develops earlier in the season than *A. webberi* and is more easily introduced into a citrus plantation. It does not, however, kill all the larvae on a leaf and usually is not so vigorous in autumn. A third species that often does great execution, particularly on the larvae of *A. nubifera*, is a *Microcera* (*Fusarium*), also called the "white-fringed fungus" [see this *Review*, Ser. A, i, pp. 266 267]. The cinnamon fungus, *Verticillium heterocladum*, also proves useful.

The best method of controlling whitefly under Florida conditions is to aid in the spread of the parasitic fungi during the rainy season and to spray with miscible oil emulsion in spring and autumn. The fungi should be introduced as soon as possible after the appearance of whitefly because the pest is usually most harmful within a year or two of becoming firmly established, which is only possible in the absence of the fungus. Artificial dissemination at the beginning of the rainy season will usually result in a much more satisfactory spread. Fungus can be obtained commercially and the preservation of a supply of fungus is recommended [see this *Review*, Ser. A, ii, p. 129]. In the case of severe infestation during the dry season, contact insecticides should be used and Yothers' formula is advised [see this *Review*, Ser. A, i, p. 187]. The lime-sulphur spray is very useful against mites, but its use is incompatible with that of fungi parasitic upon the whitefly or upon scale-insects, so that prevailing conditions must guide the grower in deciding which pest is more urgently in need of control. Another control against whitefly consists of fumigation with hydrocyanic acid gas.

A. citri has been observed to mature on the following plants, arranged approximately in order of preference: Chinaberry and umbrella tree, all varieties and species of citrus, Cape jessamine (*Gardenia florida*), privet, prickly ash, Japanese and native persimmons. Less severely infested plants include, among others, cherry laurel, coffee, pomegranate, honeysuckle, blackberry and oleander. The destruction of the wild and useless plants, particularly the chinaberry, is advisable when they grow near citrus plantations.

Rivière (C.). **Sauterelles et Criquets.** [Locusts and grasshoppers.]—*Bull. Soc. Nat. Acclimat., Paris,* lxi, no. 16, September 1914, pp. 535–540.

This article describes the damage done to vegetation by locusts in North Africa. The infection of locusts by *Isaria, Botrytis, Sporotrichum, Entomophthora, Lachnidium,* or other fungi, though sometimes successful in the laboratory, is not so in the open, chiefly because the frequent internal and external moults of the insects constitute an effective defence against infection. In any case, this is a method of control which is difficult of application, as locust invasions occur at wide intervals and only for short periods. The study of locusts has been furthered by the work of Künckel d'Herculais, especially as regards *Dociostaurus* (*Stauronotus*) *maroccanus* and *Schistocerca* (*Acridium*) *peregrina*, the most important observation made by him being the discovery of the frequent re-matings of the latter species.

Rutherford (A.). **Three Caterpillar Pests.**—*Trop. Agric., Peradeniya,* xliii, no. 3, September 1914, pp. 222–224.

In December 1913, lucerne at Peradeniya was badly attacked by *Dichomeris ianthes*, Meyr., a few of the caterpillars being parasitised by a small Braconid. In April 1914, cassias were defoliated by *Catopsilia crocale*, Cramer, the caterpillars of which habitually congregate between the limbs at the base of the tree. They were there fed with branches of cassia, sprayed with lead arsenate, but these soon wilted in the sun. A few Chalcids and several Dipterous puparia were observed on *C. crocale*, but were not reared. The surrounding bushes and trees were covered with pupae, of which crows and king-crows destroyed large numbers. In March 1913, the fronds of *Cycas revoluta* were destroyed by the Lycaenid *Euchrysops* (*Catochrysops*) *pandava*, being stripped to the midrib.

Wenholz (H.). **The Field Selection of Seed Maize.**—*Agric. Gaz. N.S.W., Sydney,* xxv, no. 9, September 1914, pp. 779–790.

On the North Coast of New South Wales, the grain weevil [*Calandra* sp.] and the Angoumois grain moth [*Sitotroga cerealella*] are the most serious maize pests. Both are most troublesome in early maize, but without doubt a large percentage of the damage they cause in the field before any treatment can be applied, may be avoided by selection of varieties with a well developed husk, as ears which are insufficiently protected by the husk, are more liable to attack. An examination of ears free from these pests in the field revealed, in most cases, not only sufficient protection, so far as length of husk was concerned, but also that the husk was closed tightly over the tip of the ear. That the percentage of infection in the field may be diminished by selection seems to be demonstrated by sowing the seed from different ears in separate rows. Here some rows were badly affected by the weevil while others were comparatively free, and investigation showed that in most cases the character of the husk was to blame. There seems no reason why, if attention be given to this matter of selection and also to the subsequent treatment of the ears and grain when stored, growers should not be able to cope more satisfactorily with these two pests.

Gurney (W. B.). **Spraying for Thrips.**—*Agric. Gaz. N.S.W., Sydney*, xxv, no. 9, September 1914, p. 821.

Apple and pear blossoms should be sprayed against thrips with tobacco wash [see this *Review*, Ser. A, ii, p. 705] prepared as follows: Steep 1 lb. of tobacco refuse overnight in a gallon of water; strain off the liquid in the morning, and add ¼ lb. soft soap with a gallon of hot water; apply while still warm, though not hot. The addition of the soft soap will be an advantage in the first spraying, as it makes the tobacco adhere better, but should be used more sparingly in later applications to the open blooms.

Pescott (E. E.). **Orchard and Garden Notes.**—*Jl. Agric., Victoria, Melbourne*, xii, pt. 9, September 1914, pp. 573–575.

In September, spraying vigorously with tobacco solution to destroy the peach aphis, *Aphis amygdali*, Fons., and against the rose-scale, *Aulacaspis rosae*, Bouché, with lime-sulphur wash or kerosene emulsion, is recommended.

Surface (H. A.). **Sow Wheat late to avoid Hessian Fly.**—*Zool. Press. Bull., Penns. Dept. Agric., Harrisburg*, no. 281, 14th September 1914.

The following precautionary measures against *Mayetiola destructor*, Say, are advised:—The soil should be well prepared and sown immediately after the first frost, provided it is not earlier than the third week of September. This applies to S. Pennsylvania; more northward or at higher elevations it may be proportionately earlier.

McGregor (E. A.). **Some notes on Parasitism of Chrysopids in South Carolina.**—*Canadian Entomologist, London, Ont.*, xlvi, no. 9, September 1914, pp. 306–308, 1 fig., 2 tables.

Species of *Chrysopa* in cotton fields usually pupate in the apical buds at the terminal portion of the stalk. The pubescence of the foliage at this point has a greyish appearance, which the cocoon much resembles. Several lots of *Chrysopa* cocoons were collected and studied for their parasites, and out of 99 observed, 18 yielded parasites, and three species of *Chrysopa* were bred, viz:—*C. rufilabris*, Banks, *C. nigricornis*, Burm., and *C. oculata*, Say, the majority being the first-named. The parasites, in order of abundance, were: *Chrysophagus compressicornis*, Ashm., the Chalcids, *Perilampus* sp. n., *Goniocerus* sp. n., *Isodromus iceryae*, How., the Ichneumon, *Orthizema atriceps*, Ashm., and *Helorus* sp. n. *C. compressicornis*, besides being frequently reared from Chrysopids, on one occasion was reared from an undetermined Syrphid pupa from which the Chalcids, *Pachyneuron allograptae*, Ashm., and *Syrphophagus mesograptae*, Ashm., were also obtained.

Girault (A. A.). **Notes on the Hymenoptera, Trichogrammatidae and Mymaridae.**—*Canadian Entomologist, London, Ont.*, xlvi, no. 9, September 1914, pp. 327–330.

The author has received from Java a large number of both sexes of *Trichogramma australicum*, Girault, from the eggs of *Chilo infuscatellus*, which was the first known host of this species, although in Queensland it attacks native Lepidoptera. Among others reared from an unknown Tortricid, was a single male of *Paranagrus optabilis*, Perkins, which was probably not from the Lepidopterous eggs. A number of both sexes of *Trichogrammatoidea nana*, Zehntner, from eggs of *Diatraea striatalis* were also received from Java. *Anagrus armatus*, Ashm., was received from Porto Rico from egg-clusters of *Delphax saccharivora* in cane leaves; *Aphelinoidea semifuscipennis*, Gir., var. *albipes* var. nov., from the same locality from egg-clusters of a leaf-hopper; *Ufens niger*, Ashm., from leaf-hopper eggs in cane, together with *Oligosita comosipennis*, Gir., from Porto Rico, and *Brachisbella prima*, Perk. *Trichogramma minutum*, Riley, from egg-clusters of *Diatraea saccharalis*, was received from many new localities, including Mexico, Louisiana, Texas, Porto Rico, and British Guiana.

"Practicus". **О болѣзняхъ и поврежденіяхъ ягодъ винограда и мѣрахъ борьбы съ ними.** [On the diseases of and injuries to grapes and remedies for them.]—**«Садоводъ.»** [*The Fruit-Grower*], *Rostov-on-Don*, no. 9, September 1914, pp. 683–685.

This is a general description of the diseases and pests of the vine. Amongst the latter, *Polychrosis botrana*, Schiff., is the most common in South Russia, there being two generations during the summer. The remedies consist in thoroughly cleansing the bark of vines in autumn by means of steel brushes, in order to destroy the pupae in the cracks. In destroying the caterpillars, special attention must be paid to those of the first generation in the middle of June, when their webs can be easily seen; bunches of straw scattered among the vine stocks as traps for the caterpillars should be used. The grapes are also damaged by wasps and hornets, and their nests should be destroyed. The control of *Pseudococcus* (*Dactylopius*) *longispinus* must be started in spring, when the vine stocks should be smeared with sticky bands to protect the branches from the larvae which emerge from the earth; after blossoming, the vines must be sprayed with djipsin, or with a solution of 1 part of green soap, and 1 part of kerosene in 20 parts of water.

Kamber (A.). **Борьба съ вредителями садовъ посредствомъ Джепсина.** [The fight against pests of orchards by means of Djipsin.]—**«Садоводъ.»** [*The Fruit-Grower*], *Rostov-on-Don*, no. 9, September 1914, pp. 715–717.

The author refers to the advantages of djipsin over Paris green and gives a recipe for the preparation of the former, the cost of which is less than that of the commercial article; 3 oz. of sodium arsenite and 16 oz. of lead acetate are dissolved, in separate earthenware vessels, in hot water, the solutions are then mixed together and water is added to

make up a total of 135 gallons. This proportion proved very effective against *Hyponomeuta malinellus*, *Cheimatobia brumata*, various species of TORTRICIDAE, *Cydia pomonella*, *Euproctis chrysorrhoea*, *Malacosoma neustria*, *Aporia crataegi* and *Lymantria dispar*. It did not cause scorching of the foliage of either old or young trees, and no further sprayings were necessary.

FROGGATT (W. W.). **Australasian Hispidae of the Genera *Bronthispa* and *Promecotheca* which destroy Coconut Palm Fronds.** *Bull. Entom. Research, London*, v, pt. 2, September 1914, pp. 149–152.

The following species of HISPIDAE are causing serious damage in the coconut plantations of Australasia: *Promecotheca opacicollis*, Gest., the New Hebrides Coconut Hispid, first recorded in the north islands about 1905, was a plague in all the islands in 1911. The damage done is two-fold, the adults gnawing long parallel furrows down the centre of the fronds, and the larvae mining in them and forming brown blisters up to 6 inches long and ½ inch wide. The fronds die back, in consequence, to their junction with the trunk, causing the nuts to fall while still immature. *P. coeruleipennis*, Blanch., the Fiji Coconut Hispid, which is restricted to Fiji, and is abundant in March and April, but is heavily parasitised in the egg, larval and pupal stages, does similar damage. Other species are:—*P. antiqua*, Weise, the Solomon Islands Coconut Hispid, previously recorded from New Britain and German New Guinea; *P. callosa*, Baly, the Queensland Coconut Hispid, also found in N. Australia; *P. ruripes*, Baly, the Port Darwin Coconut Hispid, found on the foliage of Pandanus. *P. biroi* and *P. papuana* have been described from German New Guinea, but have not been recorded as coconut pests. *Bronthispa froggatti*, Sharp, the Leaf-bud Hispid, the larvae of which feed with the adults on the epidermis of the opening leaf-buds, was originally recorded from New Britain, later from the Solomon Islands, and in 1913 from the New Hebrides. The former control method of spraying with tobacco and soap wash is now replaced by the cutting off and burning of the tips of infested fronds.

BEZZI (M.). **Two New Species of Fruit-Flies from S. India.**—*Bull. Entom. Research, London*, v, pt. 2, September 1914, pp. 153–154.

The following new fruit-flies are described from S. India: *Bactrocera (Chaetodacus) bipustulata*, sp. n., from Mysore, and *Monacrostichus crabroniformis*, sp. n., from the Shevaroy Hills; while two African species are recorded from India for the first time: *Leptoxyda longistyla*, Wied., from Coimbatore, on *Calotropis procera*, and *Dacus brevistylus*, Bezzi, from Siddhout, Cuddappale, on melon.

QUELCH (J. J.). **Report on the Control of the Small Moth Borers, *Diatraea saccharalis* and *Diatraea canella*, with some General Notes.** Demerara: Argosy Co., September 1914, 15 pp.

Investigations as to the possibility of an effective control of *D. saccharalis* and *D. canella* are described, together with lists of the

number of egg-clusters collected and the percentage of parasites found in them. A new infestation is best checked by the collection of the egg-clusters at the earliest possible time, certainly not later than about three weeks after the canes have been cut. The destruction of the borers in the "dead hearts" [see this *Review*, Ser. A, i, p. 104] and in refuse material prevents egg laying; trap lights for the moths are advantageous for small areas. Natural checks are the most effective of all controls and great harm is done by burning the fields before the canes are cut, a practice which results in a far greater destruction of the parasites than of their hosts; the cutting down of the field does similar harm, unless the parasites can be preserved in neighbouring grass or cane fields. All collecting gangs should be made to recognise the distinction between the earlier and later stages of the eggs of *D. saccharalis*, as the latter are likely to contain the parasite, *Prophanurus alecto*. The lists given, show the number of egg-clusters collected, and the percentage of those parasitised, for nearly every day of the year; the figures show a marked reduction in the number of egg-clusters, often with increase of the parasite percentage, indicating the value of the control work, which consisted in early egg-collection and the preservation and re-distribution of the parasites. The results are more satisfactory in small than in large areas. It is often advisable to collect parasitised black clusters from fields of high canes, before they are burnt or cut, for distribution among young, infested ones. It is suggested that hard-backs and frog-hoppers may shortly have to be dealt with as cane pests.

SEVERIN (H. H. P.) & SEVERIN (H. C.). **Relative Attractiveness of Vegetable, Animal and Petroleum Oils for the Mediterranean Fruit Fly** (*Ceratitis capitata*, **Wied.**)—*Jl. N.Y. Entom. Soc., New York*, xxii, no. 3, September 1914, pp. 240–248, 1 fig.

An account of a further series of experiments is given [see this *Review*, Ser. A, i, p. 517], in which the number of fruit-flies captured in kerosene (Star oil about 120° Bé.) compared with that caught in other oils, is taken as giving the relative attractiveness of the oils for the fruit-fly. Traps containing many kinds of oils were hung in orange, lemon, and other fruit trees. The relative attractiveness of various oils for the fly—kerosene being taken as 100 per cent.—was found to be as follows:—*Vegetable oils*: citronella, 1 per cent.; turpentine, ·04 per cent.; coconut, ·0 per cent.—*Animal oils*: whale, ·0 per cent.; fish, ·0 per cent.—*Mineral oils*: naptha distillate, 103 per cent.; benzine, 82 per cent.; gasoline (about 63° Bé.), 61 per cent.; gasoline (about 86° Bé.), 27 per cent.; export oil, 34 per cent.; Star oil (kerosene), 100 per cent.; mineral seal oil, 14 per cent.; colza burning oil, 1 per cent.; "Perfection" signal oil, ·1 per cent.; "Renown" engine oil, 6 per cent.; Atlantic red engine oil, ·0 per cent.; crude petroleum, 68 per cent. The attraction of *Ceratitis capitata* to these oils was confined almost entirely to the male sex, though female flies were present in the orchards, hundreds being caught by sweeping with an insect net. A bibliography of the subject is given.

SEVERIN (H. H. P.), SEVERIN (H. C.) & HARTUNG (W. J.). **The Ravages, Life-History, Weights of Stages, Natural Enemies and Methods of Control of the Melon Fly (*Dacus cucurbitae*, Coq.)**—*Ann. Entom. Soc. Amer., Columbus, Ohio*, vii, no. 3, September 1914, pp. 178–207, 6 plates, 4 figs., 11 tables.

Dacus cucurbitae, Coq., the most destructive pest of the Cucurbitaceae in the Hawaiian Islands, is responsible for a loss there of nearly a million dollars annually. The native home of this fly is not known, but it was imported into the Hawaiian Islands about 1897, since when it has rapidly increased. The eggs are laid on the more tender parts of the plant and the larvae devour the tissue of the tender stems and then penetrate the roots, destroying entire plants. The old stems and roots of pumpkins are also often infested with the larva of a Cerambycid, *Apomecyna neglecta*, Pasc., (*pertigera*, Thoms.). The larvae of *D. cucurbitae* also devour the seeds and fleshy parts of the pods of string beans, and this species has been bred from numerous cucurbitaceous vegetables, besides mango, orange, and papaw. An average of 31 flies were reared on single staminate flowers, including the long peduncles, and from 183 to 637 were reared on single pumpkins, from $2\frac{1}{2}$ to 4 inches long. The average egg stage was found to be $1\frac{1}{4}$ to $1\frac{1}{2}$ days, the larval $3\frac{3}{4}$ to 11 days, and the pupal 10 to 14 days. Experiments show that egg-laying begins 14 to 17 days after the adults emerge, and the complete life-cycle thus varies from 29 to 43 days. There are probably from 8 to 12 generations a year. The flies usually feed during the early morning, and were frequently found feeding on the flowers of glue bushes, sunflowers and Chinese bananas, never on pumpkin flowers, though frequently on the juices of injured or infested plants. The dragon fly, *Pantala flavescens*, F., is believed to prey upon these flies, but examinations of their alimentary canals showed no signs of this; the Reduviid, *Zelus peregrinus*, Kirk., and perhaps Staphylinids are predaceous on them. The Chalcid, *Spalangia hirta*, Hal., was bred from puparia of the melon fly, three parasites emerging from 500. Burying infested cucurbitaceous plants is a commonly recommended method of control, but experiments show that a covering of less than 3 feet of soil is useless, though lime would probably destroy the larvae if buried in sufficient quantity with the plants, but would increase the cost. Experiments on the effects of submergence on the larvae show that if infested vegetables be submerged in a tank of water for four days, and then ploughed in, the insects are destroyed and a valuable fertiliser is added to the soil. Screening is not practicable, because the screens keep out not only the flies but also those insects which fertilise the flowers; cantaloupes when set among cucumbers as trap crops, failed to protect them. When a Japanese fly-trap, similar to the American glass-trap, with molasses as a bait, was wired in an orange tree, in 12 days, 19 male and 58 female Mediterranean fruit-flies, 3 male and 1 female melon flies were drowned in the soapy water, but 2 American glass fly-traps, when set in a pumpkin patch, caught no Trypetids; twelve common mosquito screen fly-traps were equally unsuccessful. Herrick's moth trap and other night traps failed to attract any melon flies. The effectiveness of the poisoned bait spray, already used against *Dacus oleae*, Rossi, *Ceratitis capitata*,

Wied., *Rhagoletis pomonella*, Walsh, *R. cingulata*, Loew, *R. fausta*, O.S., and *Epochra canadensis*, Loew, was tested for *D. cucurbitae*; 10 kerosene traps were wired in different parts of an orchard, and 10,239 flies were captured in five weeks, of which only 36 were females; poisoned bait-spray was then applied to the trees once a week for the following five weeks, only 182 flies being caught in the kerosene traps. In captivity the adults show a preference for diluted molasses, especially during the fortnight before the egg-laying period; poisoned molasses sprayed on the food-plant when the flies are emerging should therefore kill many of them. The poisoned bait was composed of: brown sugar 2½ lb., lead arsenate 5 oz., water 4 gal.; the brown sugar and lead arsenate were dissolved through cheese-cloth in cold water, so as to eliminate foreign bodies, and the mixture was agitated with a common brass spray pump. The text is freely illustrated and a bibliography is appended.

SICARD (L.). **Etude de la bouillie bordelaise. Composition et préparation rationelle.** [A study of Bordeaux mixture. Its proper composition and preparation.]—*Progrès Agric. Vitic., Montpellier*, xxxi, nos. 33-38; 16th, 23rd, 30th August; 6th, 13th, 20th September 1914; pp. 211-217, 235-241, 263-266, 289-291, 304-309, 323-327.

Chemists have not been eager to determine the actual composition of Bordeaux mixture, owing to the many technical difficulties involved. Pickering more or less solved the question and in the present paper it is the results of his researches which are brought to the notice of vine-growers, together with those obtained by the author, the chief chemist at the National School of Agriculture at Montpellier, with the object of showing how Bordeaux mixtures more efficient than those at present obtainable may be prepared. The principal facts resulting from this study of the subject are as follows:—When a pure milk of lime is very slowly poured into an energetically stirred solution of copper sulphate (containing 1 kilo of pure copper sulphate), the Bordeaux mixture obtained is acid as long as the total amount of pure quicklime added is under 168·5 grammes. When the quantity of lime reaches 168·5 grammes, all the copper is rendered insoluble. The Bordeaux mixture is then neutral and without excess of lime. Larger quantities of lime (from 168·5 to 225 grammes) produce a neutral mixture with excess of lime. In this case the alkaline condition which occurs immediately after an addition of lime does not last, the time it takes to disappear increasing with the amount of the total quantity of lime. If the weight of the lime exceeds 225 grammes, a permanently alkaline Bordeaux mixture is produced.

The reaction of the lime on the copper sulphate is very complex, producing not only the calcic sulphate, but also a number of copper compounds. These are either basic sulphates of copper or double sulphates of copper and calcium or double hydrates of copper and calcium. The formation of each of these compounds corresponds with a given quantity of lime. If the copper sulphate solution contains 1 kilo of pure copper sulphate, a quantity of lime inferior to 168·5 grammes will produce the basic sulphate of copper SO_2, 3·5CuO; with 168·5 grammes of lime the tetracupric sulphate SO_2,4 CuO

results; with 180 grammes, the pentacupric sulphate SO_3, $5CuO$; with 202 grammes, the decacupric sulphate SO_3, $10CuO$; with 225 grammes the double sulphate of copper and calcium SO_3, $5CuO$, CaO. When the quantity of lime is greater than 225 grammes, double sulphates of copper and calcium are first obtained which are richer in lime than the preceding one, and if the quantity of lime is still further increased up to 4 or 5 kilos, double hydrates of copper and of calcium are obtained. All these compounds contain water in proportions varying with the conditions of preparation, and the major part of them are united to definite proportions of calcic sulphate. Of these compounds, the tetracupric sulphate SO_3, $4CuO$, $n\ H_2O$ possesses the highest anticryptogamic value, and in preparing Bordeaux mixture its production should be aimed at, as this yields the largest amount of copper soluble under the action of atmospheric CO_2 or that arising from the life processes of the plants on which the spray is used [see this *Review*, Ser. A, ii, p. 658].

The neutral Bordeaux mixtures which are prepared in the vineyard by adding lime until blue litmus paper ceases to redden, or until red litmus paper begins to turn blue, are mixtures containing a more or less great excess of lime. The so-called acid Bordeaux mixtures produced by adding from 150 to 200 grammes of copper sulphate to the neutral mixtures are, in fact, neutral mixtures with a great excess of lime; the excess is simply less than that in the mixtures which have been employed in preparing them.

The neutral Bordeaux mixtures made in the vineyard are composed of calcic sulphate and basic sulphates of copper. The calcic sulphate forms more than one-half of the solid matter in the mixture. The basic sulphates of copper are more particularly:—the decacupric sulphate SO_3, $10\ CuO$ or the double sulphate of copper and calcium SO_3, $5\ CuO$, CaO, for the "neutral" mixtures with a slight excess of lime; the double sulphate of copper and of calcium SO_3, $5\ CuO$, $2\ CaO$, for the "neutral" mixtures with a high excess of lime. Usually, however, these various basic sulphates of copper are found together in one and the same Bordeaux mixture.

The Bordeaux mixtures prepared by pouring copper sulphate into milk of lime, are much less dense than those obtained by pouring, as is usual, the lime into the copper sulphate. In either case the same compounds are formed. With ordinary stone lime, it is possible, in practice, to obtain a milk of lime of which the CaO content is easily determinable. In this way titrated milks of lime are obtainable, and with them, it is easy to prepare "neutral" Bordeaux mixtures "without an excess of lime." Their anticryptogamic value is much superior to that of the sprays usually obtained in the vineyard. A small addition of copper sulphate transforms them into (chemically) acid mixtures. In conclusion, it may be said that the quantity of lime necessary to render the copper completely insoluble is much less than that stated by most writers. The neutrality of the mixture does not correspond with the use of a given quantity of lime, but corresponds with the addition of very different quantities of lime, varying as from 1 to 1·33. Thus litmus, phenolphthaleine and all other indicators are not accurate. The copper hydrate, which is probably formed when the lime first acts on the copper sulphate, immediately unites with the undecomposed copper sulphate to form basic sulphates of copper.

This free hydrate is only found when very large quantities of lime are in question, such as are not employed in practical work.

The usual procedure advocated for preparing Bordeaux mixture is very defective. It may be substituted by a rational, easy method which produces mixtures with a much higher anticryptogamic power. The principle of this method is as follows:—If V be the volume of Bordeaux mixture required, dissolve the given quantity of sulphate of copper, in a volume of water equal to $\frac{1}{2}$V; dissolve, separately, the quantity of lime required for the formation of the tetracupric sulphate in an equal volume of water ($\frac{1}{2}$ V); and slowly pour the copper sulphate solution into the milk of lime, vigorously stirring the while. A table is given showing the quantity of CaO in solution for various densities from 1° to 30° Baumé, so that the operator may be in a position to determine the precise quantity of copper sulphate required in order to obtain the maximum of tetracupric sulphate, SO_2, 4 CuO, in the completed spray; milk of lime of from 9° to 12° Baumé is the best for practical purposes.

The whole paper is highly technical and the subject is dealt with entirely from the chemical point of view. The results of this extensive research are however of great practical interest, as affording an intelligible explanation of the variable effects obtained by the use of Bordeaux mixtures prepared in the ordinary way.

Burrel (M.). **Instructions to Importers of Trees, Plants and other Nursery Stock into Canada.**—*Dom. Canada Dept. Agric. Entom. Branch, Ottawa*, Circular no. 4, August 1914. [Received November.]

A full explanation of regulations for persons importing nursery stock into Canada is given. The destructive insects, pests and diseases to which the regulations apply, include *Phthorimaea operculella*, the potato tuber moth, besides those previously enumerated [see this *Review*, Ser. A, i, p. 48.] The regulations made under the San José Scale Act are repealed.

Report of the Coconut Commission, 1914. *East Africa Protectorate: Nairobi*, 140 pp.

In this Report of the Commission appointed by the Governor to consider the question of the improvement of the coconut industry on the coast of British East Africa, it is stated that the increase of the coconut beetle, *Oryctes monoceros*, Oliv., and consequently the damage done can be effectively controlled by the following methods:—The destruction of all uncontrolled breeding places; the construction of traps; rewards for beetles, pupae, larvae and eggs; the introduction of a fungus parasite of the larvae. [For details of these methods applied to *Oryctes rhinoceros*, L., see this *Review* Ser. A, ii, pp. 26–28]. Appendix iii gives the legislation in force in other parts of the world to control the spread of the coconut beetle and the tapping of the palms for palm wine and includes the B.E. Africa Coconut Beetle Ordinance of 1909, which has never come into force.

NOEL (P.). **Les ennemis du Topinambour.** [The enemies of the Jerusalem artichoke.]—*Bull. Trim. Lab. Entom. Agric. Seine-Infér., Rouen*, July-August-September 1914, pp. 13–15.

A list of the enemies of the Jerusalem artichoke is given, including the following insects :—Coleoptera : *Apion basicorne*, Ill. ; Rhynchota : *Aphis lappae*, Koch, and *Aphis rumicis*, L. ; Lepidoptera : *Thyris fenestrella* (*fenestrina*), *Arctia caja*, L., *Polia* (*Aplecta*) *nebulosa*, Hfn., *Agrotis rhomboidea*, Esp., *Leucania pallens*, *Polia filigramma* (*polymita*), *Antitype* (*Polia*) *chi*, L., *Antitype flavicincta*, F., *Phytometra* (*Plusia*) *gamma*, L., *P. chrysitis*, L., *P. iota*, L., *Xanthoecia* (*Gortyna*) *flavago*, Schiff., *Phalonia* (*Conchylis*) *badiana*, Hb., (*rubigana*, Tr.), *Phalonia posterana*, Hffg., (*ambiguana*, Fr.), *Pinaris* (*Depressaria*) *propinquella*, Tr., *Pinaris* (*Depressaria*) *arenella*, S.V., *Metzneria* (*Parasia*) *lappella*, L., (*aestivella*, Z.) and *Alucita* (*Pterophorus*) *galactodactyla*, L. ; Diptera : *Trypeta tussilaginis*, F. (*arctii*), *Tephritis* (*Trypeta*) *leontodonis*, De G., *Tephritis bardanae*, Schrk., *T. cincta*, Lw., (*confusa*, Mg.), *Trypeta cylindrica* (*onotrophes*, Lw.), *Spilographa* (*Trypeta*) *zoë*, Mg., *Trypeta cornuta*, F., *Acidia* (*Trypeta*) *cognata*, Mg., *Acidia* (*Trypeta*) *heraclei*, L., *Phytomyza nigra*, Mg. (*arctii*, Kalt.), and *Agromyza lappae*, Lw. ; Nematodes : *Heterodera schachtii*, Schmidt.

NOEL (P.). **Ce que les Plantes cultivées rapportent en France ; ce que les Parasites nous coûtent.** [What cultivated plants yield in France, and what parasites cost us.]—*Bull. Trim. Lab. Entom. Agric. Seine-Infér., Rouen*, no. 3, July-August-September 1914, pp. 3–13.

It is stated that the 350 varieties of plants cultivated in France produce £360,000,000 sterling annually. They are attacked by about 6,000 species of insects and 2,000 cryptogamic diseases, which cause a loss of £120,000,000.

PRESTIANNI (N.). **Insetti occasionalmente dannosi alle viti.** [Insects occasionally injurious to the vine.]—*L'Agricoltore Agrigentino, Girgenti*, vi, nos 8–9, August-September 1914, pp. 170–171.

Labidostomis (*Clytra*) *taxicornis* is only an occasional pest of the vine. The adult's favourite food-plant is *Salix purpurea*, of which it often skeletonizes the leaves. *Adoxus obscurus* var. *vitis* is the only Chrysomelid injurious to the vine. Should control be necessary, the insects should be shaken into sheets early in the morning.

LAKIN (G.). **Очерки плодоводства въ Астраханской губерніи за 1913 годъ.** [A review of fruit-growing in the govt. of Astrachan in 1913.]—**«Плодоводство.»** [Fruit-Growing], *Petrograd*, nos. 8 & 9, August & September, 1914, pp. 526–540 and 590–596.

The position of fruit culture in the government of Astrachan in 1913 is discussed, and the insect pests dealt with. The most important of these is *Cydia pomonella*, which does an enormous amount of damage in the government, one-third and more of the crop being lost in

some localities. Good results were obtained by means of the bag-treatment, but this method is expensive and involves much labour. Any kind of paper may be used for the preparation of the bags, the best, however, being celluloid paper, and the bags should be sewn, not pasted, otherwise they collapse in rainy weather; the cost of this method is estimated at about 6*s*. per 1,000 apples. Spraying operations were conducted experimentally against *C. pomonella* and *Hyponomeuta malinellus* in one orchard. The spray consisted of 1 lb. of arsenic boiled with $1\frac{1}{2}$–2 lb. of soda in 27 gallons of water, till the solution of the arsenic was complete, after which 5 lb. of lime was added and the whole boiled again for half an hour and made up to 270 gallons with water. Spraying was carried out on 30th May, 9th June, 22nd June and 6th July; notwithstanding the rainy and windy weather, the results were excellent, the orchard being quite cleared of *C. pomonella*, whereas last year the pest destroyed two-thirds of the crop. In some other orchards Paris green with sal-ammoniac or lime was used (1 oz. of green dissolved in sal-ammoniac in 18 gals. of water or 3 oz. of green with lime in 18 gals. of water) and sprayed on 26th May, 2nd June, 18th June and 1st July, but the results were not satisfactory so far as *C. pomonella* was concerned, though *H. malinellus* was destroyed after three or four days.

SEVASTIANOV (I.). **Ближайшія перспективы Туркестанской Энтомологической Станціи по изученію и борьбѣ съ яблочной плодожоркой.** [The immediate prospects of the Turkestan Entomological Station in the study of and fight against *Cydia pomonella*.] — **« Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, nos. 8 & 9, August & September 1914, pp. 727–740 & 775–792.

This article reviews the biology of and methods of controlling *Cydia pomonella* from data collected in various countries, principally in Russia and North America. The biology of this pest is dealt with especially as regards the adaptability of the various stages of the insect to different local conditions. The imago usually appears at the time of blossoming of apple trees and oviposits two or three days after emergence. In the parts of European Russia to the south of 50° N. Lat., where there are two generations yearly, the imago is on the wing during June and in some places even in the beginning of July, but to the north of this line there is only one generation a year, the moths occurring in July. In Turkestan, there are three generations a year, one only being complete and the remaining two more or less partial, the first one appearing in April or even before. It is even probable that four generations may occur in Turkestan and that in warm winters breeding proceeds unbroken throughout the year. Very early caterpillars may feed on leaves or, as has been observed by Sacharov in Astrachan, may get into the shoots, where they behave like *Sarrothripus musculana* and various TORTRICIDAE. The destruction of this pest all over the world is principally effected in the larval stage and therefore the fact that some individuals remain in this stage over the winter is of great importance. According to data collected at the station, some 17 per cent. of caterpillars of the first generation and some 42 per cent. of the second hibernate. The length of the larval stage depends on the temperature and also on the food, and it has been

observed that on apricots and peaches they develop in a shorter time than on apples at the same temperature, while the longest time was required on pears. Probably this depends on the structure of the tissues of the fruit, and it is therefore possible that in California only two generations were obtainable, because the investigations there were conducted on pears.

The control of *Cydia pomonella* by means of natural enemies is very popular in America and also has its advocates in Russia. According to Portchinsky, there are 15 species of hymenopterous and three species of Tachinid parasites which attack this pest. In Europe more parasites occur than in America, where only six species are known, and consequently the damage done there is far greater than in Europe. As it was thought by Portchinsky that no local parasites of *C. pomonella* exist in Turkestan, several experiments were undertaken by Vassiliev and Radetzky to import *Pentarthron carpocapsae*, Ashm. from Astrachan, but in 1912 Plotnikov discovered in Ferghana a parasite of this pest similar to the Astrachan species, and in 1913 another local egg-parasite was discovered in Tashkent. Of the last species, which is of a bright yellow colour, several parthenogenetic generations were obtained and no males have been observed. This parasite attacks the eggs of all species of TORTRICIDAE, especially those of *Pandemis chondrillana*, the eggs of which are similar to those of *C. pomonella*, but are laid in heaps and not singly, the parasite leaving uninfested the majority of the eggs in the centre of the heap. Some eggs of *C. pomonella* which were infested by this parasite on 7th September produced another generation, while others did not give rise to parasites, the latter probably remaining in the egg-stage over the winter. Thus the importation of parasites from Astrachan proved to be quite unnecessary and the whole question of the biological method requires still further research and study.

Besides the egg-parasites, other enemies of *C. pomonella* were observed in 1913, the most important being an Ichneumon, *Hemiteles carpocapsae*, Kok., a new species which will shortly be described by Kokujev. This is an external parasite, the females attacking the caterpillars of *C. pomonella* in the cocoons, 41 per cent. of the hibernating individuals being infested. The process of oviposition by this parasite is described at length; the female first drives its ovipositor through the cocoon into the body of the caterpillar and tries to prevent the escape of its victim from the cocoon by striking it with its antennae and jaws over the head; after about an hour the caterpillar becomes quite motionless and the parasite deposits on it from one to five eggs. Frequently the caterpillars are able to escape from the cocoons after the first attack by the parasite and in such cases the latter follows its victim, makes fresh wounds with its ovipositor and drinks its blood. A species of *Ascogaster* and some other parasites which have not yet been identified or studied, have been observed. A mite, *Pediculoides ventricosus*, Newp., also attacks the caterpillars and pupae of *C. pomonella*, destroying from 5 to 25 per cent. of them, and a prominent part in their destruction is played by ants of the genera *Camponotus*, *Formica* (especially *Formica rufibarbis*) *Myrmecocystus* and others. As, however, the method of controlling this pest by means of its parasites is still far from reaching serious practical value, spraying according to the American method is a necessity.

SEVERIN (H. H. P.). **A review of the work on the poisoned bait spray; dry method and mixed treatment of controlling fruit-flies** (*Trypetidae*).—*Canadian Entomologist, London, Ont.*, xlvi, nos. 7, 8 & 9, July, August & September; pp. 243–246, 277–284 & 309–314, 3 figs., 8 tables.

This paper reviews the work of the South African, French, Mexican, United States and Canadian entomologists on various fruit-flies, leaving that of Italian entomologists for a future paper. The interval of ten days between emergence from the pupa and the commencement of the egg-laying period is spent by the fruit-flies in feeding on the nectar of flowers, waxy coating of fruit, juices of injured or cracked fruit hanging on the trees, windfalls, fallen infested fruit, and droplets of water. It is therefore clear why poisonous, sweet substances are so effective in control, especially if available when the flies first appear, as they will then be killed before oviposition.

The work of Mally, Dewar, Fuller and Lounsbury [see this *Review*, Ser. A, i, pp. 195-196] with poisoned molasses to control the Mediterranean fruit-fly, *Ceratitis capitata*, Wied., in South Africa is reviewed. In the Hawaiian Islands, good results from the use of the poisoned bait spray were obtained, despite unfavourable weather conditions; except that the amount of lead arsenate was increased from 3 to 5 ounces, Mally's 1909 formula was used ($2\frac{1}{2}$ lb. brown sugar; 4 gallons water). To check the effectiveness of the fruit-fly remedy, kerosene traps [see this *Review*, Ser. A, i, p. 517; ii, p. 578] were employed, but after five weekly applications of the bait, a thorough search was necessary to find an infested fruit in the orchard, whereas before spraying almost every ripe fruit had been attacked. In 1910, H. O. Marsh tested the poisoned bait spray to control the melon fly or bitter gourd fruit-fly, *Dacus cucurbitae*, Coq., in the Hawaiian Islands. His baits were poisoned with $\frac{1}{4}$ oz. of either Paris green or arsenate of lead, added to a solution of 1 quart of molasses and $1\frac{1}{2}$ gallons of water; neither proved effective, flies being frequently observed feeding on the poisoned liquids, but they evidently did not relish them, and so failed to consume a fatal dose. Fuller, in Natal, found that where the poisoned bait spray has been applied for the melon fly, it has proved successful. The author details his attempt to control the melon fly in Hawaii, the same formula as that used to control *C. capitata* being adopted, except that 1 ounce of a soluble poison, such as potassium arsenate or sodium arsenite, was added to the solution; but whether the pest, which has been allowed to increase unmolested during the past sixteen years, can be controlled under Hawaiian conditions, when one planter sprays and his neighbours do not, is doubtful. In all probability, better results could be obtained with the poisoned bait spray in a well-isolated cucurbit field away from the valleys, where rains are less frequent during the summer months.

Against *Dacus oleae*, the effectiveness of the De Cillis formula was confirmed by French experimenters, but as the cost of some of the materials was rather high, a more economical spray was suggested by Berlese, who discovered that it was better to double the number of applications, the cost of six sprayings being only 2d. per tree. It has always been regarded as a matter of extreme importance that the

owners of adjacent olive groves should work together, the careful spraying of one grove in the midst of a number of unsprayed ones being held to be labour more or less thrown away; it has, however, been shown that this is not altogether the case, but that treatment, even of a non-isolated, small olive grove, would reduce the infestation by 40–50 per cent. Experiments were made in 1912 with the poisoned bait spray on 10,000 trees in isolated plantations, the formula used being $2\frac{1}{2}$ lb. sodium arsenite and 33 lb. of molasses in 22 gallons of water, at a cost of about a halfpenny per tree. The results were most satisfactory, a reduction of from 60–80 per cent. or more in the infestation being effected, though there is no doubt that the complete isolation of the groves was an important contributory factor; but the commercial value of spraying is undoubted, as the weight of sprayed olives required to yield a given quantity of oil is three as against five of unsprayed ones. Careful analysis has shown that there is no fear of the oil containing appreciable quantities of arsenic, the only disadvantage being, that if the spray contains less than 30 per cent. of sugar it is apt to promote the growth of certain fungi. The dry method has the advantage of abolishing spraying and thus warding off danger from fungi; the cost is reduced, the unfavourable action of rain is overcome and the difficulty of procuring water in certain regions, such as Southern Italy, is met. Various devices have been adopted, such as bottles containing the mixture and provided with cotton wicks along which it drips, or small canvas bags filled with bran and sawdust soaked in poisoned molasses, 8 parts bran, 21 sawdust, and 71 molasses by weight. The results from the use of these poison bags in an isolated plantation of 620 trees, though showing a great diminution of infestation, were not so good as those obtained by spraying in the two preceding years, and in a non-isolated grove of 675 trees the results were little or nothing. Pans of poisoned molasses with pieces of rag floating in them, to afford a resting place for the insects, were tried by Chapelle and Ruby at the rate of 1 pan to 40 trees, but the method was found to have no practical value.

The mixed treatment consists of a combination of spraying and the bag method (1 bag to 5 trees) the object being to reduce the number of sprayings and keep down the labour bill. The results were only fairly good and not satisfactory in all cases. Poisoned bait is not so effective in olive groves containing cultivated shrubs or situated near woods, as the fly can obtain shelter and food from other plants. The maximum effect is obtained when the grove is isolated and free from all other vegetation. The omission of the treatment in the plantation experimented upon for one year caused an increase of infestation from 22 to 81 per cent. The treatment was therefore clearly of value.

While working on the control of the Mexican or Morelos orange worm, Betanzos discovered the usefulness of a common poisonous Mexican herb (*Haplophyton cimicidum*). Two pounds of the herb, cut fine, were thoroughly boiled in three gallons of water, 2 pounds of sugar added, and the whole decoction was then strained and used as a spray. Rangel obtained very satisfactory results from the use of this preparation in combating the Mexican fruit-fly (*Anastrepha ludens*, Loew).

O'Kane used a mixture of arsenic, molasses and water to control the apple maggot, *Rhagoletis pomonella*, Walsh, in New Hampshire,

but the results were mostly negative, owing, probably, to the proximity of infested unsprayed trees and to the inability of the growers to spray as often as necessary. In one instance, however, an isolated tree so treated, yielded a good crop. In 1911, in New York, Illingworth prevented oviposition by *R. pomonella* by using :—Syrup 4 pints, potassium arsenate 1 lb., and water 45 pints, with a second application four days later; and in 1912, adopted similar control methods against the cherry fruit-flies, *R. cingulata*, Loew, and *R. fausta*, O. S., but as in the case of the apple maggot, there is some evidence that arsenate of lead without the addition of sweet substances may prove effective against them.

SEMENOV (R. S.). **Мой способъ леченія гнильца.** [My method of curing foul-brood.]— **« Русскій Пчеловодный Листокъ.»** [*Russian Beekeeping Gazette*], *Moscow*, nos. 8 & 9; August & September 1914; pp. 275–278 & 294.

In this paper, the author reports on the effects of the remedies usually recommended for foul-brood, such as β-naphthol, formic acid, formalin, etc. As it appears certain that the infection occurs in the comb and honey and in the bodies of the bees themselves, the remedy must attack all these sources of infection at the same time. The bees, therefore, must not be allowed to visit neighbouring hives nor be starved in the swarming hive. The disinfected food given them must be eaten by the bees even when the pollen they may have gathered is present, but there is no necessity for isolating the queen bee in a separate cell for 21 days, and so interrupting oviposition and the normal life of the hive. The author describes his method as follows :—Into an empty hive, containing from five to nine frames with artificial foundations, a frame from a diseased hive, containing a queen was introduced, care being taken to select for this purpose one as little infected as possible and not yet completely filled with honey. More bees from the diseased hive were then shaken into the new one. The new hive containing the queen bee is put in the place previously occupied by the old one and the bees returning with pollen enter it without suspicion. From the old infected hive, all the combs not occupied by larvae are removed, the comb warmed, formic acid added to the food and some days later, in the evening, all the queen cells are removed and replaced by others naturally sealed. The next morning the new hive was disinfected when most of the bees had already departed to collect pollen and while the remainder were busy building the comb. Opening the hive carefully, the bees are quickly shut out from the comb so as to prevent them from taking honey from it, and the frame is then returned to the old hive. The bees remaining on the floor of the hive were then sprinkled with a mixture of honey and a 10 per cent. solution of formic acid by means of a small brush. All the bees on the floor and the walls of the new hive were thus treated and were obliged to consume the honey adhering to them and to retain it for about 24 hours until they started rebuilding a new comb. Hurried shaking prevented them from taking the infected honey, while the abundant moistening compelled them to take disinfected food and thus disinfect themselves. The old hive was left as described above for about 20 days, by which time all the larvae would have

emerged, and the bees from it were shaken into a third hive filled with frames with foundations of artificial wax and to the table of which a frame with empty wax cells was fixed. Into this, bees from one or more hives can be concentrated, and treated in the above manner, a queen being added if necessary. In this second new hive, the frame with the wax cells must be removed next day and the bees sprinkled as above described. No foul brood was noticed in the new hives treated in this way. The incubation period of the disease is three weeks and the author warns beekeepers not to delay in taking measures against it immediately it has been noticed.

Perez (T. de S.). **Cavallette, loro invasioni e la lotta contro di esse in Sicilia.** [Locusts, their invasions of and the fight against them in Sicily.]—*Giorn. Sci. Nat. ed Econ., Palermo,* xxx, 1914. pp. 117–199, 16 figs.

The author was delegated by the Ministry of Agriculture in 1910–11 to direct the operations against locusts in the province of Palermo, where they had greatly increased for several years and had become an important pest of agriculture. The area covered by *Dociostaurus maroccanus* amounted to about 10,000 acres, but the locusts appeared to concentrate chiefly in the district of Petralia. They destroyed even the hard leaves of *Eryngium campestre, Carolina gummifera, Scolimus esculentum* and other wild plants. The use of locusticides, hopper-dozers and trenches was precluded by the character of the country, but the insects were sprayed with a mixture of 2 parts benzine and 1 part of petroleum and burned. Under the local conditions, destruction of the eggs in autumn, winter and spring is considered the method of most value. Ploughing or hoeing the soil to the depth of 1½–2 inches in the localities where the eggs are deposited is sufficient to expose them to the air, and they may either be collected and destroyed or left to the weather, which will kill most of them. If the work be delayed until spring, they must be collected, otherwise exposure to sun and air will accelerate the hatching. One of the best methods for local use consists of driving the locusts into cloths, 6 yards by 5 yards, with a hole in the middle 12 inches to 14 inches in diameter, to which a sugar bag is attached. One such cloth with bag attached caught from 5 to 8 cwt. of larvae or nymphs in a day. If used from 4 to 9 a.m. and 4.30 to 7.30 p.m. the full-grown insects could also be caught before they had oviposited, but the method is useless during the hot hours of the day. Twelve women and children are required to woik each cloth and bag, and two men to carry the full sacks and dig holes for burying the insects, besides one to direct operations, the whole cost being a little more than £1 per diem. This method is satisfactory against small invasions, but when the attack is serious and occurs in broken, rocky country, it cannot be properly carried out. The invasions vary greatly in gravity, which is attributed to the efficient work of natural enemies. One of the chief obstacles to the successful destruction of the pests is the fact that the vineyards on the slopes of the Madonian mountains are under the forest laws, and spade cultivation of the soil is not permitted, as in this case the melting snows would carry it down the slopes into the valleys below.

Oviposition goes on undistuibed in these vineyards, and the peasants

do nothing to keep down the pests, while in the lower and more level country they believe that the locusts will never do much harm until the swarms which have developed higher up the mountain side, having eaten all they can find, descend in search of food. The peculiarities of the climate tend to produce the sudden appearance of vast swarms. The month of May in 1911 was exceptionally cold and wet, and the hatching of the ova was delayed in consequence. A rapid change to great heat caused a sudden hatching, and over an area more than 25 miles long the whole country-side swarmed with hoppers; as its conformation made operations exceedingly difficult, though much good work was done, large numbers reached the adult stage and migrated to other areas.

During the last four years, although *Dociostaurus* (*Stauronotus*) *maroccanus* was the chief pest, *Calliptamus italicus* also appeared in large numbers, though the eggs were much attacked by the Bombyliid fly, *Cytherea obscura*.

Tettigonia (*Decticus*) *albifrons*, F., is widely distributed and very plentiful all over the island, and has damaged grain and also a few vineyards. This insect has been observed to be associated with certain locusts, in some cases in very large numbers. Though a partial grain-eater, it may be forgiven the damage done because of the number of locusts it destroys. The other long-horned locusts, *Uromenus* (*Ephippigera*) *rugosicollis* and *Dericorys annulata*, Fieb., are not much to be feared, though they tend to increase. Their area of operation is necessarily limited, and, although they have carnivorous propensities, they do considerable damage at times to the grain called "Timilia," [a variety of hard wheat sown in March, *Triticum amyleum*, known in good Italian as "grano marzuolo"] which is the last to be cut and the only succulent material left in the hottest part of the year. *Mylabris variabilis*, Pall., var. *lacera*, Küst., is common in the egg tunnels of *D. maroccanus*, and eats the egg-masses. Another species, *M. schreiberi*, Reiche, also found in Sicily, has been observed doing similar work in Algeria, and Künckel d'Herculais observed in France vast quantities of *M. variabilis* following swarms of *Calliptamus italicus*. Brysson observed in France that *Mylabris* frequented places where *Oedaleus* (*Pachytylus*) *nigrofasciatus*, De Geer, *Springonotus* (*Oedipoda*) *coerulans*, L., *Calliptamus italicus*, L., *Gomphocerus rufus*, L., and various species of *Stenobothrus* were abundant. *Mylabris schreiberi* has been found by Künkel in the egg-masses of locusts, and specially those of *D. maroccanus*. The author found *Mylabris* larvae in July in the holes of *D. maroccanus*, and in August he caught several female *Mylabris* in the act of ovipositing in the soil close to the nests.

Another Clerid beetle, *Trichodes ammios*, F., var. *flavicornis*, Germ., was found by the author exclusively in the egg-pits of *D. maroccanus* in fair numbers, and in well-established haunts of *D. maroccanus* hundreds of this *Trichodes* might be seen flying round the flowers of species of *Centaurea*. *T. apiarius*, L., is a parasite of bees; *T. alvearius*, F., lives in the nests of *Osmia*, *Megachile* and *Anthophora*; *T. octopunctatus*, F., in those of *Chalicodoma rufescens*, Licht. The Bombyliid fly, *Cytherea obscura*, F., is the most active and numerous of the egg-parasites of *D. maroccanus* and probably of other

locusts, the author having found it in places in which *D. maroccanus* was unknown and *C. italicus* rare. Egg-masses of *D. maroccanus*, collected in winter on the lower slopes of the Madonian Mountains, were found to be infested by *Mylabris* and *Cytherea*.

Attention is drawn to the failure in the field of *Empusa* (*Entòmophthora*) *grylli*, although laboratory experiments were successful; in the open the fungus only attacks the insects after their life-cycle is complete. Detailed descriptions are given, with figures of the various parasitic insects referred to above; the question as to how far they may be made use of in practice is discussed, the opinion being expressed that they are at least worthy of further study and experiment. A classified list of animal and fungus parasites is given in tabular form and a summary of the answers received to nine questions on the subject of locusts, their ravages and mode of suppression, submitted by the International Institute of Agriculture.

PACZOSKI (J. K.). **Обзоръ враговъ сельскаго хозяйства Херсонской губерніи и отчетъ по Естественно-Историческому Музею за 1913-1914 годъ.** [Review of the enemies of Agriculture in the govt. of Cherson and report of the Natural History Museum for 1913–1914.]—Published by the Zemstvo of the govt. of Cherson. *Cherson*, 1914, 26 pp.

This report covers a period of 11 months to 14th September. The principal insect pest during the year was *Anisoplia austriaca*, Herbst, an outbreak of which occurred in the southern part of the government, while only single specimens were noticed in the northern part. The pests were observed in the south on 10th June, but probably really appeared some days earlier. Handpicking was carried out as a remedy. Winter-sown wheat was damaged in some localities by *Mayetiola destructor*, Say, in autumn, but the crops recovered in spring. *Cephus pygmaeus*, L., was found as usual, nearly everywhere. *Epicometis hirta*, Poda, appeared in small numbers, as was also the case last year after a few years of outbreaks. *Oscinis frit*, L., was observed in small quantities on barley and oats in the northern parts of the government. *Pentodon monodon*, F., injured maize in June on one estate of the district of Cherson. The larvae of *Athalia spinarum*, F., did considerable damage to winter-sown rape in the north-western part of the district of Alexandrisk in August 1914. *Adelphocoris lineolatus*, Goeze, was observed on lucerne in one locality of the district of Ananjev. *Phlyctaenodes sticticalis*, L., the caterpillars of which caused great damage last year, were practically absent this year. *Otiorrhynchus ligustici*, L., has damaged roots of lucerne in one locality of the district of Cherson. In fact, but for the outbreak of *Anisoplia austriaca*, the year was very favourable as far as insect pests were concerned.

As regards orchard pests the following are reported: *Euproctis chrysorrhoea*, L., *Malacosoma neustria*, L., *Cydia pomonella*, L., *Acronycta tridens*, Schiff., *Hyponomeuta malinellus*, Zell., and *H. variabilis*, Zell., all of which appear yearly in more or less great numbers. *Lepidosaphes ulmi* (*Mytilaspis pomorum*) was noticed for the first time. Gooseberries in the district of Cherson were damaged by *Bryobia ribis*, Thomas. *Chermes* were observed on pines in Cherson, in which town *Psylla piricola*, Forst., was also found. On old roots

of vines, *Termes lucifugus*, Rossi, was observed in a locality in which it had already been noticed some years before and where it appears to be now firmly established, notwithstanding the severe winters. *Eulecanium* (*Lecanium*) *robiniarum*, Dougl., which has during late years greatly developed on white acacia, has quite disappeared during the year under report.

Experiments with a new insecticide, "Uraniagrün," an arsenical preparation in the form of a fine powder of a bright green colour, which can be applied without lime, are recorded. In the proportion of 1 per 1,000 of water, this insecticide was very effective against caterpillars of *Hyponomeuta malinellus*, *Malacosoma neustria* and *Euproctis chrysorrhoea*, the death rate being the same as from Paris green in salammoniac. No scorching of the leaves was observed. Although the specific gravity of Uraniagrün is 0·75, being less than that of Paris green, which is 1·2, the powder nevertheless settles down somewhat quickly on the bottom of the vessel.

Emelianov (I. V.). **Сельскохозяйственная Энтомологія въ Соединенныхъ Штатахъ Сѣверной Америки.** [Economic Entomology in the United States of America.]—Published by the Department of Agriculture of the Central Board of Land Administration and Agriculture. *Petrograd*, 1914, 275 pp., 128 figs.

This book describes the author's views on Economic Entomology in the United States, acquired during visits paid by him to that country, first as a member of the American Agency of the Zemstvo of the government of Ekaterinoslav during 1910–1911, and again in April 1912, when he was deputed by the Zemstvo of the government of Charkov to study this subject there at the expense of the Department of Agriculture. The position of Economic Entomology in the United States, covering every branch of its activity, and the organisation and the method of working of the various departments of the Entomological Bureau of Washington, are fully described, as also are the stations in the individual States. Special attention is paid to the scientific researches conducted by the Bureau and its branches, and descriptions are given of the work that is being done on various pests of Agriculture, their biology, parasites, etc. Special chapters are devoted to the American Association of Economic Entomologists, the literature on Entomology appearing in America, and with the most important insecticides and sprayers in use.

Hewitt (C. G.). **Report from the Division of Entomology, for the Fiscal Year ending 31st March 1913.**—*Dom. of Canada Dept. Agric.*, pp. 501–518. [Received 2nd November 1914.]

Most of the records of insect pests dealt with in this report have already appeared in this *Review*. The area of infestation by *Euproctis chrysorrhoea* (browntail moth) in New Brunswick increased from about 400 square miles in 1910 to about 6,400 square miles in 1911; the infestation was light, only 2,452 winter webs being found. In New Brunswick, birds contributed to the destruction of the larvae. The discovery of the larvae of *Compsilura concinnata* in caterpillars of *Hyphantria cunea*, three miles from the point where these parasites had been liberated, showed that the Tachinids had crossed the

St. John River, ¾ mile wide. *Pegomyia fusciceps* was unusually destructive in Ontario. Of insects affecting fruit crops, more than one species of bud-moth, *Eucosma*, occurs in Nova Scotia, and the spray usually recommended for them is not effective; a larger species, *Olethreutes frigidana*, Pack., has proved injurious. The first occurrence of *Rhagoletis pomonella* was observed at Smith's Cove, N.S., but it appears to be localised and the infestation in the affected orchard was light. Cocoons of *Nematus erichsonii*, parasitised by *Mesoleius tenthredinis*, were colonised in Manitoba in May 1912. The following bark-beetles were noted in Manitoba: *Dendroctonus murrayanae*, Hopk., *D. simplex*, Lec., *Ips perturbatus*, Eichh., *I. caelatus*, Eichh., *Polygraphus rufipennis*, Kirby, *Trypodendron retusum*, Lec., and *T. lineatum*, Ratz., also *Pissodes*, and *Agrilus anxius* [see this *Review*, Ser. A, i, pp. 406–407.] Observations on the habits and life-histories of the following were made: *Dryocoetes eichhoffi*, Hopk., on birch, *Dendroctonus* and *Dryocoetes* in white spruce, *Polygraphus rufipennis*, in white and black spruce, *Ips balsameus*, on balsam, *Monohammus scutellatus*, etc. *Tortrix fumiferana* is reported to be spreading eastward. *Chermes similis*, Gillette, *C. abietis*, Chol., *C. pinicorticus*, Fitch, *C. strobilobius*, Kalt., are noted, also *Coleophora laricella*. *Gossyparia spuria*, Mod., is proving injurious to elms in Ottawa. Among other forest and shade tree pests, the following were the most abundant: the beetle, *Galerucella decora*, on willow and poplar, the moth, *Podosesia syringae*, Harris, on lilac, *Cyllene robiniae*, Forst., on acacias, and the Longicorn, *Elaphidion villosum*, on oaks.

Shtcherbakov (Th. S.). **Замѣтка о непарномъ шелкопрядѣ.** [A note on *Lymantria dispar*, L.]—Reprint from **«Труды Естественно-Историческаго Музея Таврическаго Губернскаго Земства.»** [*Memoirs of the Natural History Museum of Zemstvo of the govt. of Taurida*] *Simferopol*, iii, 1914, 34 pp.

This paper deals with *Lymantria dispar* and is the first comprehensive study of this pest in the Russian language. The various stages are described, and the distribution of the very young larvae by wind, which is facilitated by their very long hairs, is discussed at great length. Control of this pest should be directed principally against the eggs and must be made compulsory on all owners of estates, etc., as is the case in Connecticut, U.S.A. The caterpillars of the first and second stages preferred the foliage of apples, pears and apricots. They less frequently attacked quinces, cherries and dogwood, and refused willow, pine and cypress.

The last chapter deals with *L. dispar* as a pest of forests, and the entomological and biological researches of various American authors are reviewed, the necessity for similar researches in Russia being urged. An index of the titles of 19 publications on *L. dispar*, of which 10 are in Russian, is appended.

Ksenjopolsky (A. V.). **Отчетъ о дѣятельности Волынскаго Энтомологическаго Бюро.** [Report on the work of the Entomological Bureau of Volhynia.] Published by the Zemstvo of the govt. of Volhynia, *Jitomir*, 1914, 24 pp.

The Entomological Bureau of the Zemstvo of Volhynia was established in the autumn of 1913 and started operations in 1914, the author

being appointed Director. In addition to the work of the Bureau, the Agronomic Branch of the Zemstvo deals with the establishment of hiring stations for sprayers and insecticides, the various district Zemstvos organise demonstrations against insect pests in their respective districts, and district consulting advisers supervise the control of insects in orchards and hop gardens. The scientific part of the work is left to the Entomological Bureau, which conducts general investigations, the collection of data on insect pests, experiments on the application of various remedies to the local conditions, the popularisation of entomological knowledge, and the general supervision of all work undertaken against pests. The estimates of the Bureau for 1914 amount to about £400, half of which is covered by a grant from the Department of Agriculture, the other half being borne by the Zemstvo.

Uvarov (B. P.). **Отчетъ о дѣятельности Ставропольскаго Энтомологическаго Бюро за 1913 годъ.** [Report of the Entomological Bureau of Stavropol for 1913.]—Published by the Department of Agriculture of the Central Board of Land Administration and Agriculture, *Petrograd*, 1914, 86 pp., 1 plan and 1 sketch map.

The work of the Bureau during the year under report is reviewed, the most important section consisting in the supervision and direction of the campaign against locusts. Two new insecticides were tried against locusts, one of these "Locusticide," made by an Anglo-American firm, proving very effective and handy, while the second, "Phytonal" of the Schweinfurt chemical factory, did not give satisfactory results. Trials of two new sprayers showed the excellent qualities of the "Holder" sprayer. A list is given of injurious insects recorded in the government.

The only Myriapod mentioned, *Blanjulus guttulatus*, was found in a maize field injuring the grain, but as it was in company with Elaterid larvae it is doubtful how far it was responsible for the primary injuries. The Arachnids, *Tetranychus* sp., *Eriophyes vitis*, Land., and *E. pyri*, Pagst., were observed in various localities, the first-named having in two cases injured the foliage of plum trees. Orthoptera, with few exceptions, were nowhere important; *Dociostaurus* (*Stauronotus*) *maroccanus*, Thunb., was only found sporadically and did practically no damage; in still less numbers were *Arcyptera flavicosta, Celes variabilis, Oedipoda coerulans* and in one case *Dociostaurus* (*Stauronotus*) *kraussi*, Ingen. Far more danger was threatened by *Locusta migratoria*, L., which, coming from the adjoining province of Terek, infested with its egg-clusters nearly 60,000 acres, in the autumn of 1912, but thanks to a timely spraying with Paris green, and sodium arsenite with zinc oxide, this pest was nearly everywhere totally destroyed. The cost of the campaign amounted to £6,300. Only some 135 acres were noticed to be infested with eggs in the autumn of 1913, to which, however, must be added 11,600 acres on which a swarm coming from the neighbouring province succeeded in ovipositing. Egg-clusters of *Oedaleus nigrofasciatus, C. variabilis, Tmethis muricatus* and *O. coerulans* were also observed, but no precautionary measures were necessary. Vineyards in one locality were damaged by *Oecanthus pellucens*, Scop., and *Gryllotalpa gryllotalpa*, L., was reported from many places

in this and some neighbouring governments and in some cases caused serious damage. Of the Rhynchota (Hemiptera), *Sehirus bicolor*, L., is quite common in the government and was observed in an orchard in Stavropol between 9th and 21st April. Grain crops were more or less damaged by *Eurygaster integriceps*, Put., *E. austriacus*, Schr., *E. maurus*, L., *Aelia acuminata*, L., *A. sibirica*, Reut., *A. rostrata*, Boh., and *A. furcula*, Fieb.; *Graphosoma italicum*, Mull., was found occasionally on bush fruit; *Palomena prasina*, L., on wheat; *Dolycoris baccarum*, L., common from April to August on lucerne, horse-radish and in the trap belts of fruit trees. *Eurydema ornatum*, L., the imagines of which hibernate, is one of the most serious pests of cabbage; the Proctotrupid, *Trissolcus simoni*, Mayr, was reared from the eggs and a fly of the genus *Phasia* from the imagines. *E. festivum*, L., mostly occurred on wild Cruciferae, and *E. oleraceum*, L., on cabbage and horse-radish. *Tingis pyri*, F., was noticed on pear trees and the Anthocorid, *Montandoniella dacica*, Put., on fruit trees. On lucerne, there were found more or less frequently: *Piezodorus lituratus*, *Corizus* (*Rhopalus*) *parumpunctatus*, Shill., *Corizus* (*Stictipleurus*) *crassicornis*, L., *Adelphocoris seticornis*, F., and *A. lineolatus*, Goeze, the last-named being the most abundant and important. Near Stavropol large numbers of *Lygus pratensis*, L., were noticed on lucerne in July and in September. It also occurred singly on gooseberries and black currants, as did *Lygus campestris*. *L. pabulinus*, L., and *L. kalmi*, L., were observed singly on fruit trees. *Poeciloscytus cognatus*, Fieb., was found in July on sunflowers in considerable numbers; *Liocoris tripustulatus*, Fall., on blossoming currants and gooseberries in April; *Notostira erratica*, L., and *Trigonotylus ruficornis*, Geoffr., on wild cereals; *Typhlocyba rosae*, F., on roses and apple trees; and *Psylla pyricola*, Forst., on pears. *Pemphigus ovato-oblongus*, Kessel., *P. pyriformis*, Licht., *P. protospirae*, Licht., and *P. bursarius*, Licht., are all common on poplar trees. *Tetraneura ulmi*, Deg., *Tetraneura rubra*, Licht., *Schizoneura ulmi*, Deg., are also mentioned, and *Schizoneura lanigera*, Haus., is commonly found in orchards in the province of Kuban. *Anoecia corni*, F. is common in October on leaves of *Cornus sanguinea*; *Callipterus juglandis*, Frisch., and *C. juglandicola*, Kalt., on walnuts; *Pterochlorus roboris*, L., on oak; *Chaitophorus nassonowi*, Mordw., on poplar; *Macrosiphum rosae*, L., common on roses; *M. pisi*, Kalt., singly on lucerne; *Hyalopterus pruni arundinis*, F., common in May and June on plums, peaches and apricots, and in August on *Phragmites communis*; *Myzodes* sp. n. on sunflower, chiefly on varieties grown for oil, while those grown for eating were more attacked by *Aphis euonymi-papaveris*. Contrary to the experience of 1912, *Toxoptera graminum*, Rond., occurred sparingly. Aphids were on the whole scarce, probably owing to their natural enemies, chiefly COCCINELLIDAE (*Adalia bipunctata* being the commonest), SYRPHIDAE, and species of *Chrysopa*. *Aphis pomi*, Deg., occurred on apples and quinces; *A. idaei*, Goot., on raspberries; *A. laburni*, Kalt., and *A. gossypii*, Glov., on pumpkins; *A. brassicae*, L.; *Brachocolus noxius*, Mordw., on pears; *Aphis* sp. n. on millet. *Lepidosaphes ulmi* (*Mytilaspis pomorum*) damaged apples and poplars and was also found on willows and barberries; *Eulecanium* (*Lecanium*) *corni*, Sign., was very injurious to *Robinia pseudacacia* in the neighbouring province of Kuban.

Lepidopterous pests included caterpillars of *Papilio podalirius*, L., damaging the foliage of peaches; cabbages were seriously damaged by *Pieris brassicae*, L., from the larvae of which, *Anilasta ebenina*, Grav., and *Apanteles glomeratus*, L., were reared; while *Pteromalus puparum*, L., was reared from one pupa of *Pieris rapae*, L. The larvae of *Phalera bucephala* occurred on lime trees and wintered as pupae. *Euproctis chrysorrhoea*, L., has damaged pear trees, and *Lymantria dispar*, L., about 5 per cent. of apples in one locality, while injury by *Malacosoma neustria*, L., was reported from various places. Larvae of *Saturnia pyri*, Schiff., were occasionally found on fruit trees, and those of *Acronycta rumicis*, L., on raspberries in July. Great numbers of caterpillars of *Euxoa segetum*, Schiff., occurred on the experimental fields near Stavropol, the largest number being found on the plot containing potatoes, less on the plot of maize and still less on black fallow, there being apparently two generations. They were parasitised by *Macrocentrus collaris*, Spin., and *Ichneumon sarcitorius*, L. The caterpillars of *Barathra* (*Mamestra*) *brassicae* appear to be specially injurious to late sown cabbage. *Chloridea* (*Heliothis*) *dipsacea*, L., was on the wing in July doing some damage to ripe crops. The caterpillars of *Phytometra* (*Plusia*) *gamma*, L., were found on cabbage and sunflowers. *Cossus cossus*, L., seriously damaged apple trees in one district. Great damage was caused by *Homeosomane bulella*, Hb.; on the experimental field near Stavropol, caterpillars of this pest were found nearly exclusively on the edible varieties of sunflower seeds, those used for oil being practically free from them. The caterpillars of *Phlyctaenodes sticticalis*, L., have seriously injured lucerne in one locality. Fruit trees were damaged by *Cydia* (*Grapholita*) *funebrana*, Tr., especially plums and sloes, and *C. pomonella*, L., has done considerable damage to apple trees. *Hyponomeuta malinellus*, Zell., has been very destructive, as also has *H. variabilis*, Zell., which totally denuded all the plum and sloe trees in one locality. The caterpillars of *Plutella maculipennis* (*cruciferarum*, Zell.), which appeared only in small numbers, were heavily infested with *Phaiogenes plutellae*, Kurdj., and *Angitia fenestralis*, Holmgr.

As regards Coleopterous pests, serious damage to millet in the district of Stavropol was caused by *Pardileus calceatus*, Duft., swarms of which came to light. *Byturus tomentosus*, L., was very common and frequently injured the buds of raspberries in spring and early summer. *Laemophloeus testaceus*, F., and *Silvanus surinamensis*, L., were found in grain stores. The larvae of *Athous niger*, L., which injured sown maize near Stavropol, occurred together with *A. tartarus*, Cand., and also large numbers of the larvae of either *Agriotes lineatus*, L., (*segetis*, Bj.), or *A. gurgistanus*, Fald. *Melanotus brunnipes*, Germ., occurred on sunflowers. An outbreak of *Epicauta erythrocephala*, Pall., is attributed to the presence of *Locusta migratoria*; it injured potatoes and was controlled by spraying with Paris green. Great numbers of a species of *Omophlus* were found in June and July on the ears of grain crops and on other plants. *Lema melanopa*, L., was reported from some places. Although *Adoxus* (*Eumolpus*) *vitis*, F., is not yet known as a pest in North Caucasia, a beetle which answers to its description has been reported to damage vine blossoms in the neighbouring province. Larvae of *Haltica quercetorum*, F. (*erucae*, Ol) were found in the first

half of August on oaks and on *Corylus*, but no serious damage was done. *Colaspidema* (*Colaphus*) *hoefti*, Men., together with *Phyllotreta* sp., have done great damage to mustard; the breeding of *C. hoefti* is favoured by the abundance of wild Cruciferae in the steppes and it makes the cultivation of mustard nearly impossible in those areas. *Aphthona euphorbiae*, F., is a serious pest of linseed and was found together with *Phyllotreta vittula* and *Psyllodes* sp. in one locality. Cabbages were more or less injured by *Phyllotreta armoraciae*, Koch, *P. cruciferae*, Gz., *P. vittula*, Redt., and *P. undulata*, Kut. Vetches (*Vicia sativa*) were injured by larvae of *Bruchus* (*Laria*) *atomarius*, L., while *B. lentis* was reported on lentils. On lucerne, there were found *Sitones longulus*, Gyll., *S. humeralis*, St., both in great numbers, and *S. hispidulus*, F. The following Curculionid pests of fruit trees were reported:—*Sciaphobus squalidus*, Gyll., *Anthonomus pomorum*, L., the hibernating adults of which appeared in the first half of April, *Rhynchites betuleti*, F., var. *violaceus*, Scop., *R. auratus*, Scop., *R. bacchus*, L., *R. pauxillus*, Germ., and *R. aequatus*, L. On 18th July a large flight of *Amphimallus solstitialis*, L., was observed near Stavropol and another of *Rhizotrogus aestivalis*, Oliv., on 28th April. *Adoretus nigrifrons*, Stev., is widely distributed over the eastern part of the government. The wheat chafers of the genus *Anisoplia* have not done much damage during the year under report; investigations have shown that *Anisoplia austriaca*, Herbst, var. *major*, Rttr., is the most common, especially in the east, being replaced to some extent by *A. cyathigera*, Scop., in the west; *A. zwickii*, Fisch., and *A. segetum*, Herbst, also occur. Maize, watermelons and sunflowers were injured in the south by *Pentodon monodon*, F. (*idiota*, Herbst). No great damage was done by *Epicometis* (*Tropinota*) *hirta*, Poda, which did not appear in large numbers; strawberries were seriously injured in one locality by *Oxythyrea stictica*, L.

Dipterous pests included *Mayetiola destructor*, Say, which damaged winter-sown crops near Stavropol in September and October. *Oscinis frit*, L., v. *pusilla*, Meig., appeared on fallen crops and winter-sown ones in September; the following Chalcid parasites of this pest were reared: *Pteromalus* (*Trichomalus*) *cristatus*, Forst., *Rhoptomeris widhalmi*, Kurdjumov, and *Halticoptera* sp. nov.

Among the Hymenoptera *Hylotoma rosarum*, Klg., is a common pest of roses, as also are the larvae of *H. pagana*, Panz., from the cocoons of which *Tetrastichus atrocoeruleus*, Nees, was reared. Larvae of *Cladius albipes*, Klug, have injured leaves of cherries; those of *Eriocampa adumbrata*, Klug, appeared early in July and those of *Hoplocampa testudinea*, Klug, were occasionally found in apples. *Cephus pygmaeus*, L., and *Trachelus tabidus*, F., are very injurious, but it has not yet been ascertained which of the two is the more important, the differences between the larvae being still unknown. Various species of *Isosoma*, amongst which *Philachyra apterum*, Portch., was prevalent, were injurious to grain.

TRÄGÅRDH (I.). **Sveriges skogsinsekter.** [The forest insects of Sweden]. Stockholm: Hugo Gebers, 1914, 279 pp., 16 pls. 136 text figs.

This is a comprehensive treatise on the noxious forest insects of

Sweden, and also deals with those known to be useful as their enemies. The introductory chapters deal with the anatomy and biology of the insects, as well as the factors which influence their development and relations with the forests in general. The succeeding chapters deal with the various orders, and a special chapter is devoted to galls, gall-insects and mites. The factors causing outbreaks and the methods of combating insect pests in general are also discussed. The last chapter gives tables showing the damage done to the different trees, according to their age and the parts attacked. The book is amply illustrated with photographs, mostly originals.

KITCHUNOV (N. I.). **Раціональное Плодоводство.** [Rational Fruit-growing]—Supplement to *Progressive and Market-Gardening, Petrograd*, 1914, 184 pp., 136 figs.

A chapter of this book is devoted to the description of the most important fungicides and insecticides, and the use of sprayers and such remedies as trap belts, fumigation, powdering with tobacco dust, etc. With regard to the damage done by species of *Scolytus*, the one effective remedy is to cut down the bark to the bast layer, removing all the damaged parts, and immediately smearing the denuded trunk and branches with a thick coat of lime. This remedy is recommended for the whole of Russia to the South of the government of Kursk ; in the northern governments, where the summer is short, experiments are necessary before this method is applied. Torches in the form of a naphtha lamp on a stick, for destroying the nests of caterpillars remaining on the trees over the winter, are also recommended.

PLOTNIKOV (V.). **Къ біологіи сосновой пяденицы и нѣкоторыхъ ея паразитовъ.** [On the biology of *Bupalus piniarius*, L., and of some of its parasites.] Reprint from *Revue Russe d'Entomologie, Petrograd*, xiv, no. 1, 1914, 21 pp., 8 figs.

The pupae of *Bupalus piniarius* used for this investigation were collected in November 1909, and were taken from soil when covered with snow in the Turkum forest of Kurland, where this pest destroyed the pine needles at the end of summer. About 3 per cent. of the pupae collected belonged to another species, *Semiothisa* (*Macaria*) *liturata*, Cl., which could only with difficulty be distinguished from those of *B. piniarius*. In nature, the pupae lie in the earth below a mass of fallen needles and the time of emergence depends on the thickness of this cover and on the amount of shade. The eggs are deposited in lines on the lower side of old needles near the tops of the trees. The whole larval stage in captivity lasted 45 days, and the whole cycle from egg to imago, $3\frac{1}{2}$ months. In nature, this process is generally more extended, and in 1910 the imagines were on the wing from the end of April and the first pupae were found on the 8th October.

The parasites of this pest are dealt with, the first being *Lydella nigripes*, Fall., which fly is known to parasitise the caterpillars of twenty species of Lepidoptera and of two species of CEPHIDAE. The development of the larvae of this parasite first in the uterus of their parent and then in the gut of the caterpillars of *B. piniarius*, is described in detail. Never more than one larva was found in the gut

of one host. It is thought that the flies which emerge from hosts pupating in summer, oviposit in the wintering caterpillars, in which their larvae hibernate in their first stage.

Another parasite which attacks the same host, often to the detriment of the larvae of *L. nigripes*, is the Ichneumon, *Campoplex oxyacanthae*, which attacks the caterpillars of *B. piniarius* only in the last stage. The mature parasitic larva emerges from the body of the host and weaves a cocoon inside the cradle prepared by it when about to pupate. Incomplete cocoons were found on 10th October in 1910. Another Ichneumonid parasite of *B. piniarius*, which, according to Schmiedeknecht, also attacks *Panolis flammea* (*piniperda*, Panz.), *Hylophila prasina*, L., and *Anarta myrtilli*, L., is *Heteropelma calcator*, Wesm. The first imagines of this parasite were obtained on 31st July 1910, from pupae of *B. piniarius*; they were also taken in the field, mostly flying in copula. The young larvae of this parasite appear to winter inside the pupae of the host.

The following ICHNEUMONIDAE have been reared by Shevirev from pupae of *B. piniarius* :—*Ichneumon nigritarsus*, Grav., *I. albicinctus*, Grav., *I. ruficeps*, Grav., and *I. dissimilis*, Grav. These parasites infest only the pupae, and refuse to oviposit on pupating caterpillars. The process of oviposition, the eggs and larvae of these species are described.

Inside the adult caterpillars some larvae were found, believed to be *Platylabus cothurnatus*, Grav., imagines of which were reared from pupae of *B. piniarius*. Among 372 caterpillars examined, 14 per cent. were infested with *Campoplex*, 12 per cent. with *L. nigripes*, 4 per cent. with both of the above parasites and 2 per cent. with *Platylabus cothurnatus*. In all the cases of double infections with *Campoplex* and *L. nigripes*, only the former survived. The same thing happens in cases of double infections with *Campoplex* and *Heteropelma*.

SACHAROV (N.). **Волосистая пяденица и мѣра борьбы съ нею.** [*Biston hirtarius* Cl., and methods of fighting it.]—Published by the Entomological Station, *Astrachan*, 1914, 19 pp., 3 figs., 2 tables.

The caterpillars of *Biston hirtarius*, Cl., in June 1913, did great damage to quince trees in orchards in Astrachan, having in many cases entirely defoliated them. This pest is widely distributed in Russia, and in Saratov and Astrachan the caterpillars are also found on oaks, apple and pear trees. In Astrachan, the imagines appear at the end of March, males being in the majority. The larval stage lasts 55 days and that of the pupa 9½ months. Although the caterpillars of *B. hirtarius* are said to be polyphagous, in Astrachan they prefer apple, pear, and quince trees, feeding less readily on cherry, apricot, and poplars.

The pupae are attacked by a Chalcid parasite, which in 1913 was responsible for the destruction of from 18 to 22 per cent. of them. The caterpillars and pupae are destroyed by the fungus *Botrytis bassiana*, Bals., some 16 per cent. of the former and 18 per cent. of the latter perishing from this cause. After the outbreak of 1913, the numbers of this pest in 1914 were not serious, so both these parasites have controlled them.

The following remedies are recommended :—Spraying after blossoming, the best insecticides being Paris green with lime and Uraniagrün ; good results were obtained with sodium arsenite and with arsenic and lime, but these scorched the foliage ; barium chloride was not very effective and djipsin often gave negative results. Ploughing and cultivating the soil in autumn, followed by harrowing, lead to the destruction of the pupae by exposing them. In one experiment, 52 per cent. of the pupae exposed throughout the winter on the surface of the earth and 31 per cent. of those put at a depth of 2½-3 inches, were found dead, while of those in normal situations all survived, except when parasitised. Spraying the trees in early spring with iron sulphate or with a solution of lime, in order to destroy the lichens on which the females oviposit, and the smearing of the stems in autumn and spring with a paste of lime and clay strengthened by the addition of mullein leaves (*Verbascum*), in order to cover all places which might serve as shelters, are also recommended.

Ksenjopolsky (A. V.). **Результаты научной поѣздки по Волыни въ 1912 году.** [The results of a scientific journey over the govt. of Volhynia in 1912.]—Reprint from **«Труды Общества Изслѣдователей Волыни.»** [*Memoirs of the Society of Investigators of Volhynia*], *Jitomir*, xi, 1913, 85 pp. [Received 24th Dec. 1914.]

This is a report of a scientific journey undertaken by the author in 1912 to Volhynia, at the request of the local authorities, in order to investigate the local insect pests. In the forests, pines, oaks, aspens and alders are the trees most attacked, while birches and others are much less affected, ash trees being injured only by the Cantharid, *Lytta vesicatoria*, L. In orchards and market-gardens, apple, pear, plum, gooseberries, cabbage, beetroots, peas, and beans suffer most, and amongst field-crops, rape, clover, wheat and rye. On barley, no pests were noticed except *Anisoplia cyathigera* (*crucifera*).

Over 150 species of injurious insects are recorded, of which not more than about 50 are of real economic importance, including :—Lepidoptera : *Aporia crataegi*, L., *Pieris brassicae*, L., *P. rapae*, L., *Malacosoma neustria*, L., *Barathra brassicae*, L., *Phytometra* (*Plusia*) *gamma*, L., *Hyponomeuta malinellus*, Zell., *Lymantria dispar*, L., *Euproctis chrysorrhoea*, L., *Euxoa segetum* and *Feltia exclamationis*, L. Coleoptera : *M. melolontha*, L., *Phyllopertha horticola*, L., *Anthonomus pomorum*, L., species of *Scolytus* (*Eccoptogaster*), many species of Bostrychidae, *Agelastica alni*, L., *Melasoma aenea*, L., *M. populi* L., *Rhynchites betulae*, L., *Byctiscus populi*, L., *B. betulae*, L., *Pissodes pini*, L., *P. notatus*, F., *Hylobius abietis*, L., *Magdalis violacea*, L., *Anisoplia cyathigera* (*crucifera*), *A. segetum*, Hbst., *Bruchus* (*Laria*) *pisorum*, L., and the Carabid, *Zabrus gibbus*, F.

The chief damage is done in orchards and market-gardens, while field crops and forests suffer considerably less. The multiplication of the pests is favoured by the ignorance of the population and by the fact that no control measures are undertaken.

A list is added of insect pests recorded in the government up to 1912, comprising 62 pests of forests, 65 of orchards and market-gardens, and 73 of field crops.

KSENJOPOLSKY (A. V.). **Волынскіе вредители по даннымъ бывшей Продовольственной Коммисіи (1880-1897).** [The insect pests of Volhynia during the period of existence of the late Maintenance Commission (1880–1897).]—Published by the Zemstvo of the govt. of Volhynia, *Jitomir*, 1914, 29 pp., 4 maps.

The information in this book is taken from the minutes of proceedings of the late Maintenance Commission from 1880 to 1897, which recorded all kinds of information relating to the local agricultural life and data concerning various pests. Pests of fruit trees mentioned are :—*Aporia crataegi*, L., *Malocosoma neustria*, L., *Euproctis* (*Porthesia*) *chrysorrhoea*, L., and *Hyponomeuta malinellus*, Z. Though common and no less important, *Anthonomus pomorum*, L., *Byctiscus betulae*, L., *Scolytus* (*Eccoptogaster*) *pruni*, Ratz., etc., are not mentioned. Pests of cabbage and turnips : *Pieris brassicae*, L., *Aphis brassicae*, L., *Gryllotalpa gryllotalpa*, L., and *Phlyctaenodes sticticalis*, L. Pests of peas and lentils : *Polia* (*Mamestra*) *pisi*, L., *Bruchus* (*Laria*) *pisorum*, L., *Sitones lineatus*, L., and *Aphis ulmariae*, Schrk. *Euxoa segetum* and *Melolontha melolontha* are everywhere abundant and do great damage, *Anisoplia cyathigera* and *A. segetum*, Hbst., are very common, *A. austriaca*, Hbst., being only found sporadically. *Bothynoderes* (*Cleonus*) *punctiventris*, Germ., is not so important as in the neighbouring government of Kiev. *Mayetiola* (*Cecidomyia*) *destructor*, Say, is seldom found and it is thought that the references to this pest in the documents of the Commission are probably erroneous. The more important locusts are *Locusta migratoria*, L., and *Calliptamus* (*Caloptenus*) *italicus*, L. A record by the Commission of a swarm of locusts which travelled from north to south cannot apply to *L. migratoria*, which usually flies in the opposite direction, but probably refers to *Libellula quadrimaculata*, L. Four maps are appended showing the distribution of various pests in the government.

SACHAROV (N.). **О вредныхъ насѣкомыхъ Царевскаго Садоводства и возможныя мѣры борьбы съ ними.** [The injurious insects of the district of Tzarev (govt. of Astrachan) and the possible methods of fighting them.]—Published by the Entomological Station of the Astrachan Society of Market-Gardening and Agriculture, *Astrachan*, N. D. (1914 ?), 10 pp.

In this paper, read at a conference of the Zemstvo of Tzarev, it is pointed out that the district may be divided into two parts, each having somewhat different pests. One area surrounds the town of Tzarev and the principal insect pests there are *Hyponomeuta malinellus*, Zell., *Cydia pomonella*, L., *Rhynchites auratus*, Scop., *Aphis pomi*, de Geer, *Euproctis chrysorrhoea*, L., *Lymantria dispar*, L., *Malacosoma neustria*, L., *Aporia crataegi*, L., *Zeuzera pyrina*, L., *Cossus cossus*, L., *Byctiscus betulae*, L., (*Rhynchites betuleti*, F.), *Scolytus rugulosus*, Ratz., *Scolytus pruni*, Ratz., *Epicometis hirta*, Poda, and *Tingis pyri*, Geoffr. In the other part of the district the most important pests in addition to those already mentioned are :—*Anthonomus pomorum*, L., and *Hyponomeuta malinellus*, Zell., *Eucosma* (*Tmetocera*) *ocellana*, F., about seven species of TORTRICIDAE, *Biston hirtarius*, Cl., *Rhynchites aequatus*, L., *R. pauxillus*, Germ., and many

other species not yet identified. The difference in the fauna is due to the fact that the orchards in the latter area are situated on ground cleared by felling the woods, consisting of oaks, black poplars, aspen and great quantities of thorn. Much of the thorn has been left standing and favours the breeding of many pests.

The conference accepted the author's recommendations that the Zemstvo should organise local classes and lectures on pests and the measures to be taken against them, and should appoint instructors to demonstrate and supervise their control.

Miller (K. K.). **Вредныя насѣкомыя и борьба съ ними.** [Injurious insects and the fight against them.]—**Справочникъ «Южное Хозяйство.»** [*Southern Husbandry Annual*], *Ekaterinoslav*, 1914, pp. 321–340, 33 figs.

This year-book contains articles relating to agriculture and briefly refers to insect pests. Field and market-garden pests mentioned, include: *Oria musculosa*, Hb., *Pyrausta nubilalis*, Hb., (*Botys silacealis*), *Phlyctaenodes sticticalis*, L., *Anisoplia austriaca*, Hbst., *Cephus pygmaeus*, L., *Mayetiola destructor*, Say, larvae of Elateridae, *Barathra brassicae*, L., and *Gryllotalpa gryllotalpa*, Latr. Amongst the pests of orchards are many Curculionidae, including:—*Anthonomus pomorum*, L., *Rhynchites pauxillus*, Germ., *R. bacchus*, L., and *R. giganteus*, Kryn., other pests being *Hyponomeuta malinellus*, Z., *Lymantria dispar*, L., *Malocosoma neustria*, L., *Aporia crataegi*, L., *Euproctis chrysorrhoea*, L., *Epicometis hirta*, Poda, and *Cydia pomonella*, L.

Slingerland (M. V.) & Crosby (C. R.). **Manual of Fruit Insects.** New York: MacMillan & Co., 1914, xvi+503 pp. Price 8*s*. 6*d*. net.

This book is one of the latest volumes of the series of Rural Manuals, edited by L. H. Bailey, and is to a large extent a posthumous work, Professor Slingerland's manuscript having been collected and edited by C. R. Crosby. It contains a large amount of well arranged and most useful information. The insects are grouped according to the trees and plants attacked. No less than 103 species are mentioned as pests of the apple, arranged according to the part attacked. Pests of the pear and quince are next dealt with, followed by those of the plum, peach, cherry, raspberry, blackberry, dewberry, currant, strawberry, grape and cranberry, with a final chapter on insecticides. Quaintance estimated that the annual loss of the United States in fruit of all kinds due to the attacks of insects was over 66 million dollars, the largest single amount being attributed to the codling moth, the next to the San José scale, and about the same amount to miscellaneous apple insects, while the grape and plum crops were estimated to suffer to the extent of more than 8½ million dollars each annually. These enormous losses more than justify the publication of all possible information as to the habits of pests and the best known methods for their control, and this book should be of great value to all fruit-growers, as it contains this information in a concise and readily comprehensible form. The general plan is to

describe each insect very briefly, with notes as to its geographical distribution, the main facts of its life-history, the nature of the damage done and the remedial measures which have been found to be of service. What is especially valuable to economic entomologists, is a list of references to papers dealing with each insect. The 396 illustrations, particularly those showing the damage done, are good and well chosen. No less than 341 insects are dealt with and necessarily the information on each is condensed. The chapter on insecticides is brief and concentrated. The notes on control methods should enable the fruit-grower to handle insecticides intelligently and with success, and should help to deprive him of any excuse for not protecting his crops, so far as pests are concerned, by the latest and best methods known to the Economic Entomologists of the United States.

Del Guercio (G.). **Le Tipule ed i Tafani nocivi nelle Risaie di Molinella (Bologna).** [Tipulids and Tabanids in the rice-fields of Molinella (Bologna).]—*Redia, Firenze*, ix, (1913), pt. 2, 31st March 1914, pp. 299-345, 14 figs. [Received 12th November 1914.]

Tipula oleracea, L., which is injurious in the rice-fields of Bologna, appears about the middle of March, the males being first on the wing. It has been stated that the eggs hatch in from 10 to 12 days, but the time must be considerably longer, as no larvae were seen to hatch within that period, either in the laboratory or in the open. The larvae were most numerous in the meadows around the rice-fields, on roads bordering on the latter, and on the grassy banks of ditches. The larvae found in the rice-fields in spring are derived from the autumn generation of adults. Experiments show that the larvae only live on non-submerged ground, and the adult avoids water for the purpose of oviposition. Tipulid larvae were found on the lucerne and clover meadows which alternate with the rice-fields in the Molinella district. The burrows are often in contact with the stems of the plants, making it easy for the larvae to reach the leaves on which they feed. When no more tender leaves are available, the older ones and not the roots are attacked. In mid-September the earliest larvae pupate, either at the bottom of the burrow or near the surface of the ground, the pupal stage lasting seven or eight days. In 1912, the adults were on the wing about mid-October, but in 1913, as early as the 5th September, so that by the end of the month nearly all had oviposited, whereas in the preceding year oviposition had taken place in mid-October. The dates are important in respect of control measures before the winged forms appear and oviposit. The eggs are laid in the clover and lucerne fields lying among the rice-fields, so that the larvae which hatch out in autumn occur in land intended for rice cultivation in the following year. This land is ploughed up in autumn and the clods of turf harbour the larvae until the end of March, when the work of rebanking, sowing and flooding is begun. As a result the Tipulid larvae are found in the rice-fields in April. While still dry and hard, the seed is not attacked, but injury begins when the seeds are swollen with water and begin to germinate, the small larvae sometimes completely eating them out. Experimental proof was obtained in confirmation of the fact that Tipulid larvae cannot survive under water. If the rice-field is flooded to such a depth that breathing through the raised syphon

is impossible, the ground will be thoroughly cleared of infestation in a few days. Water being scarce in the Molinella district, experiments were made with lime water, from $3\frac{1}{2}$ to 4 cwt. of lime being used per acre. The best result was obtained by flooding the field with a stream of water which had passed through a cutting containing the newly slaked lime. Not only were the Tipulid larvae forced to escape with all possible speed, but earthworms were killed in large numbers. Tabanid and other Dipterous larvae also perish, while ants, *Lasius flavus*, rapidly abandon their nests. Besides these effects the presence of lime (at least in the locality where the trials were made) was a distinctly beneficial addition to the composition of the soil, which was extremely rich in organic matter. A simple cultural control consists in growing rice during two consecutive years; this will free the ground of Tipulids. If forage requirements render this course impracticable, the lucerne or clover fields should be submerged when they are to be ploughed up, i.e., from October to December. If sowing is delayed, the crop will be protected to a very great extent.

Del Guercio (G.). **Generi e specie nuove di Afididi o nuovi per la Fauna italiana,** [New genera and species of Aphididae or new to the Italian fauna].—*Redia, Firenze*, ix, (1913), pt. 2, pp. 168–196, 1 pl. [Received 12th November 1914].

The following aphids are recorded:—*Trinacriella magnifica*, gen. et sp. nov., from Sicily, on oats both wild and cultivated; an as yet unnamed form found on the roots of rice at Molinella (Bologna); a winged form of *Pemphigus* on beech from Brescia; *Syphoryne artemisiae*, del Guercio, on *Artemisia campestris* (field wormwood); *Cladobius farinosus*, from Liguria, on a common species of *Lamium* (dead nettle); *Chaitophorus montemartinii* on *Lamium purpureum*; *Stenaphis monticelli*, gen. et sp. nov., attacking reeds and canes (*Phragmites communis* and *Arundo donax*), which greatly resembles *Aphis arundinis*; *Aphis viciae*, Kalt; *Macrosiphiniella fasciata*, gen. et sp. n., on *Artemisia campestris*; and *Macrosiphon cyparissiae* var. *cucurbitae*, on a number of cultivated and ornamental plants and also on *Pyrus malus*.

Del Guercio (G.). **Specie nuove di Afidini per le Graminacee in Italia a confronto con quelle conosciute.** [Species of Aphidinae attacking Graminaceae, new to Italy and compared with known species.]—*Redia, Firenze*, ix, (1913), pt. 2, 31st March 1914, pp. 197–212, 1 pl. [Received 12th November 1914].

These are given as *Aphis avenae*, Kalt.; *A. maidis*, Fitch; *A. maidi-radicis*, Forb.; *A. hordei*, sp. nov., on *Hordeum murinum*; *A. vulpiae*, sp. nov., on *Vulpia*; and *Myzocallis saccharinus*, sp. nov., on a species of *Sagina*.

Del Guercio (G.). **Intorno ad alcuni Omotteri cecidogeni dell'Argentina.** [On certain gall-making Homoptera from the Argentine.] *Redia, Firenze*, (1913), ix, pt. 2. 31st March 1914, pp. 151–167, 2 pls. [Received 12th November 1914.]

The following new species collected by Prof. I. S. Tavares are described:—*Pemphigus canadensis* found on *Populus canadensis* and

closely resembling *P. burrowi*; *Anuraphis xanthii* on various species of *Xanthium*; *Aphis ampelophila* on vines and closely resembling *A. sambuci*, L.; *A. affinis* var. *gardeniae* var. n., on *Gardenia radicans*; *A. camellicola* on cultivated camellias; *Rhopalosiphon sisymbrii*, Del Guercio, on *Sisymbrium arnottianum*.

Del Guercio (G.). **Intorno ad un nuovo nemico del carubo in Italia: *Eumarschalia gennadii* (March.) nob.** [Concerning a new enemy of the carob bean: *Eumarschalia gennadii* (March.)]—*Redia, Firenze*, ix, (1913) pt. 2, 31st March 1914, pp. 227–232, 3 figs. [Received 12th November 1914.]

Carob beans, an important crop in Southern Italy, have been attacked since 1904 by a Dipteron believed to be *Schizomyia gennadii*, Marchal, for which the author erects a new sub-genus, *Eumarschalia*. The parenchyma of the young beans is pierced, causing them to become badly deformed, and they either drop off or are so reduced in size as to be useless. Vigorous plants which are growing rapidly in the summer months prior to gathering are not attacked, which is of importance from the point of view of control. In the injured beans are minute larvae of a deep orange-yellow colour. Oviposition takes place in the summer and autumn, the ovipositor being thrust deep down into the bean, and in some districts from 50 to 60 per cent. of the crop is affected. The only control possible at present is the collection of the injured beans toward the end of summer, just before harvesting. These should be placed in an oven or in boiling water in order to kill the pests and may then be made use of.

Del Guercio (G.). **Il parassita del Rinchite dell'Olivo.** [The parasite of the Olive Rhynchites.]—*Redia, Firenze*, ix, (1913) pt. 2, 31st March 1914, pp, 233–234. [Received 12th November 1914.]

The irregularity in the occurrence of the species of *Rhynchites* which does serious injury to the olive, is due to a parasite, first discovered in 1911, but not previously recorded. Laboratory and field observations show that under circumstances not yet understood, the weevil larvae may sometimes be completely exterminated by a minute nematode, which attacks them when they burrow into the soil after leaving the olive. The dead larvae become covered with a felt-like mass, consisting of innumerable minute worms. In those years in which the parasite does not occur, great damage is done by this weevil.

Del Guercio (G.). **Intorno a due nuovi Vacunidi del Castagno.** [Concerning two new Vacunids of the Chestnut.]—*Redia, Firenze*, ix, (1913) pt. 2, 31st March 1914, pp. 285–291, 1 pl. [Received 12th November 1914.]

Two new Aphids found on *Castanea sativa*, Goert., are described, viz.:—*Vacuna castaneae* and *V. carlucciana*.

NOTICES OF ENTOMOLOGICAL APPOINTMENTS, &c.

Mr. C. Mason has recently taken up the post of Entomologist to the Department of Agriculture, Nyasaland.

Dr. W. A. Lamborn, late Entomologist to the Department of Agriculture, Southern Nigeria, has been appointed Travelling Entomologist in East Africa under the Imperial Bureau of Entomology, in the place of Mr. S. A. Neave, and is engaged on *Glossina* work in Nyasaland.

The work of the Sleeping Sickness Commission of the Royal Society having now terminated, Mr. W. F. Fiske and Dr. G. D. H. Carpenter are continuing their investigations into the bionomics of *Glossina* in Uganda under the direction of the Imperial Bureau of Entomology.

Mr. A. W. Jobbins-Pomeroy, lately in the employ of the United States Bureau of Entomology, has been appointed as Entomologist to the Department of Agriculture for the Southern Provinces of Nigeria.

Mr. R. Veitch, late Entomological Assistant to the Imperial Bureau of Entomology, has taken up the post of Entomologist to the Colonial Sugar Refining Company, Ltd., in Fiji.

NOTICES

The Editor will be glad to receive prompt information as to the appearance of new pests, or of known pests in districts which have hitherto been free from them, and will welcome any suggestion the adoption of which would increase the usefulness of the Review.

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Bureau, are requested to communicate with the Assistant Editor, 27, Elvaston Place, Queen's Gate, London, S.W.

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THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

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AUCHÈRE (A.). **Culture de la Vanille à Madagascar.** [Vanilla Cultivation in Madagascar.]—*Bull. Econ. Madagascar, Tananarive*, xiv, no. 2, May 1914. pp. 125–126.

Apart from the common vanilla pests, bugs are recorded from Antalaha and Andovoranto as attacking the pods and young shoots. One species of these has been recognised as the Pentatomid, *Memnia vicina*. The only practical control for this pest seems to be fumigation with cyanide.

MANTLE (A. F.). **Protection of Birds: Saskatchewan.**—*Agric. Gaz. Canada, Ottawa*, i, no. 6, June 1914, pp. 467–468. [Received 16th December 1914.]

The Useful Birds Act of Saskatchewan gives protection to all insectivorous birds, their nests and eggs. A conservative estimate of the total food of Saskatchewan birds during the spring and summer months is 633,000 bushels of noxious insects and weed-seeds daily. Assuming the feeding period to be 160 days, the birds consume over 100,000,000 bushels of insects and weed-seeds, which if allowed to propagate would eventually destroy all farm crops and make the country uninhabitable.

O'KANE (W. C.). **The Apple Maggot.**—*New Hampshire Agric. Expt. Sta., Durham*, Bull. no. 171, July 1914, 120 pp., 8 pls., 2 figs., 27 tables, 7 charts. [Received 29th December 1914].

After giving some details of the history of the apple maggot or railroad worm, *Rhagoletis pomonella*, particulars of investigations elsewhere than in New Hampshire are given, including those of Ross [see this *Review* Ser. A, i, p. 403]. The known food-plants of this pest are the apple, both wild and cultivated, hybrid crabs, the haws (*Crataegus* spp.), which seem to be the original host, huckleberries and blueberries; the infested blueberries are *Vaccinium pennsylvanicum*, *V. canadense*, *V. vacillans*, and *V. corymbosum*. The three common species of huckleberries in the north-eastern states are *Gaylussacia dumosa*, *G. frondosa*, and *G. resinosa*, a fourth species, *G. brachycera*, being found in the central eastern states only. The distribution of the apple maggot approximates with the so-called Alleghanian Zone, its greatest abundance and destructiveness being reached in Maine, New Hampshire, parts of Vermont, Massachusetts, Connecticut and New York, as well as in Ontario, Michigan, and Pennsylvania. In New Hampshire, where the species is one of the most important apple-pests, infestation has existed in many places for at least twenty-five years. Wild apples are prevalent in the southern half of the State and are usually infested, and of 125 growers who made observations on this point, 103 stated that this was the case in the wild fruit near their orchards. There is no doubt that seedling-apples, especially such as drop and become soft before frost begins, are generally infested. Details of the annual damage and seasonal fluctuations from 1909 to 1913 are given, the total damage to cultivated fruit fluctuating from year to year, often in inverse proportion to the size of the apple crop. Extensive tables are given showing the degree of susceptibility

to attack in varieties of cultivated apples. Early ripening varieties and those with sweet flesh or aromatic flavour seem to suffer most, while of the first 12 varieties on the list in order of freedom from infestation, 11 have a tough or a thick skin. Emergence of the adults begins in the last week of June or the first of July, is at a maximum in the second or third weeks of July, and is practically at an end by the middle of August; in New Hampshire there is no indication of a second brood, and considerable evidence that none exists. The egg is deposited slightly beneath the skin of the fruit, sweet or aromatic fruits being preferred. With a tree of a susceptible variety the only factor of consequence determining the amount of infestation is the relative abundance of females compared with the amount of fruit available. Adult females normally exhibit a tendency to remain in the immediate locality where emergence has taken place; when attractive fruit is not available, they are forced to disperse, but apparently seldom travel more than a few hundred yards. The results of extended trials of poison bait sprays and of poison trap pans lead to the conclusion that the adults of *R. pomonella* are not noticeably attracted to such substances as sugar, glucose, and molasses.

The duration of the egg stage is from five to seven days, a mellowness of the pulp being essential to the full development of the larva. The length of the period between the dropping of the fruit and the exit of the larvae is a matter of much importance economically, if control measures are to be directed towards this phase of the life-cycle. For this reason, part of the investigation was arranged with a view to securing considerable data on the varying lengths of this period and the factors that influence them. One table gives a list of varieties studied, together with the ripening season of each, and ten others detail the exit of larvae from dropped fruit. In apples of an early, soft type, one-fourth of the larvae may issue by the end of the first week after the apple falls. With early fruit of firmer flesh, less than 5 per cent. issue during the first week, the maximum occurring in the third week. With autumn apples, 1 per cent. or less issue in the first week, and in the second and succeeding weeks this depends on the tendency towards rapid decay. With hard, winter fruit, a few larvae may issue during the first four or five weeks. In most cases, larvae issue more quickly from fruits that fall towards the close of the season than from those falling early. In the case of winter fruit, few larvae mature from fruits falling after the third or fourth week in September. The great majority of the larvae issue at night. There is often a high mortality in the egg and larval stages of *R. pomonella*; the average observed was 64·2 per cent., but in late winter varieties the mortality may reach 100 per cent. The duration of the larval stage may not exceed about thirty days, or may be greatly prolonged, as in hard, winter fruit. Mature larvae leave the fruit and pupate, normally, in the soil, beneath or close to the apple, at a depth of one or two inches. The duration of the pupal stage is variable, as this species exhibits both a one-year and a two-year life-cycle; in the former the pupal stage occupies, approximately, 300 days. Some individuals, both early and late maturing, require an extra year for the pupal stage, and emergence of the adults from these pupae occurs at the normal time in the second summer.

Poison bait sprays, in three years' extended trials in New Hampshire, have entirely failed to insure satisfactory protection of fruit from attack by the maggot. There may be some indirect benefit from ordinary orchard spraying, probably in part through lessening the number of dropped fruit. In many New Hampshire orchards in which thorough spraying for codling moth was done, attack by the maggot on certain trees persisted undiminished, if the conditions, as regards a susceptible variety and neglect of the dropped fruit, were favourable to it. The critical point in the larval stage lies in the fact that fruit must drop and reach a certain degree of mellowness before the larva can mature and leave it, and a successful measure which takes advantage of this fact is the collection of dropped fruit at sufficient intervals to prevent them from decaying on the ground. Satisfactory use has been made of pigs, sheep and cattle for this purpose. Poultry may be employed successfully, if confined to a limited area in sufficient numbers; their value lies, in part, in their ability to destroy pupae already in the soil. Experiments with applications to the soil of kerosene emulsion, "black leaf 40," Clift's Insecticide, commercial lime-sulphur, and Phinotas oil, failed, to produce satisfactory results. Emergence of the adults cannot be prevented by burying the pupae by ploughing, or cultivating the soil. The small, home orchard, which often consists of susceptible varieties, is frequently a danger to the community, as it is not well looked after, and is often closely adjacent to neglected, infested wild apples, while trees in a large commercial orchard are generally free from this source of trouble. With winter-fruit showing egg-punctures when picked, prompt cold storage is advisable, as delay will result in rapid deterioration.

A ground beetle, *Agonoderes pallipes*, F., was found in considerable numbers in soil where, in a field experiment, pupae of *R. pomonella* had been buried, but although pupae were found partly eaten in confinement, the beetles were never actually observed to destroy them. A bibliography of 66 references is appended to this elaborate paper.

PATTI (M.). **Un pericoloso nemico dei cereali e degli orti.** [A dangerous cereal and garden pest.]—*Il Rinnovamento Economico-Agrario, Trapani*, viii, no. 7, July 1914, pp. 132–134. [Received 9th January 1915.]

Against *Agriotes lineatus*, which has injured onions, tomatoes and cabbages in the Trapani district, the following control methods are recommended:—Heavy green manuring with mustard; the injection of carbon bisulphide (40 cubic centimetres per square metre); the use of chemical manures, such as nitrate of soda and sulphate of ammonia and of superphosphate mixed with 5 or 6 % of its weight of petroleum. Potato bait-traps, poultry, lime (about 6 cwt. per acre), and the working into the soil of sand mixed with heavy tar oil are other remedies. A mixture of water and tar oil is also mentioned as efficacious in protecting beans against this wireworm, the rows of beans being watered with this solution before being covered with earth.

VITKOVSKY (N.). **Очередныя задачи Энтомологическаго Подотдѣла Екатерин. Губ. Земской Управы.** [The immediate tasks of the Entomological Branch of the Zemstvo of the govt. of Ekaterinoslav.]—« **Южное Хозяйство.**» [*Southern Husbandry*], *Alexandrovsk*, no. 12, 13th July 1914, pp. 435–437. [Received 4th January 1915.]

Attention is called to the establishment of an Entomological Branch by the Zemstvo of the government of Ekaterinoslav, the objects of which are to assist the public in controlling agricultural pests, etc. The methods by which the Branch intends to conduct its work are detailed.

VERMOREL (V.) & DANTONY (E.). **Pourquoi les verdets neutres rougissent le tournesol.** [Why neutral copper acetates redden litmus paper.]—*Progrès Agric. Vitic., Montpellier*, lxii, no. 30, 26th July 1914, pp. 112–114.

Both acid and neutral copper acetates redden litmus test paper, which is therefore useless as a test for acidity.

All water soluble copper salts scorch the vine if applied in sufficient strength for a sufficiently long time, and neutral copper acetate is no exception to this rule. A simple solution of copper sulphate dries rapidly and scorching occurs if any moisture subsequently re-dissolves the salt. To prevent this, the copper sulphate is replaced by other compounds which are insoluble, and this is what is aimed at in the preparation of Bordeaux and Burgundy mixtures. Neutral copper acetate is transformed by drying into insoluble basic acetate. Rapid drying means a rapid transformation, and scorching is therefore present to some slight extent if the application be made in damp weather. At first sight it may therefore be thought that copper acetates are inferior to other sprays if the application has to be made in wet weather, but in practice the opposite is the case. Vine-growers find that leaves which are slightly scorched by copper acetate are better preserved from mildew. It would appear that the prolonged presence on the leaves of a concentrated solution of a copper salt has a more antiseptic action than that of the very weak Bordeaux or Burgundy mixtures, even if they be correctly prepared. Hence the superiority of copper acetates.

FULLER (C.). **The pumpkin stem-borer** (*Apomecyna binubila*, **Pasc.**) —*Agric. Jl. Union S. Africa, Pretoria*, viii, no. 2, August 1914, pp. 240–242, 3 figs.

This small Longicorn beetle occurs along the Natal coast, southward into the eastern Cape Colony, is abundant at Pietermaritzburg, and possibly has a much wider range inland. It attacks curcurbitaceous crops and there is some evidence that the insect is at least two-brooded. Observations made during May in Pietermaritzburg showed that the parent beetle lays an egg in the leaf-stalk near the base, and the young borer, before entering the main stem, feeds sufficiently upon the tissue of the stalk to kill the leaf. A great number of borers may inhabit a single stem, and several larvae or their cocoons have been found a few

inches apart. The larvae become mature in the autumn (mid-April onwards) and remain in their cocoons throughout the winter, passing only a comparatively short time in the pupal stage. Evidence of attack by this borer is very pronounced, the stem appearing severely bruised and torn, and becoming straw-coloured; it is often split and swollen, and pale gall-like excrescences, formed of ejected pellets in a glutinous mass, are present.

FULLER (C.). **The bindweed gall-maker** (*Nupserha apicalis*, **F.**).—*Agric. Jl. Union S. Africa, Pretoria*, viii, no. 2, August 1914, pp. 242–244, 5 figs.

The bindweed is an introduced plant, which in Pietermaritzburg and its environs has been adopted by the Longicorn, *Nupserha apicalis*, as a host. The native plant on which this beetle lives has not been determined, but it is probably an indigenous *Convolvulus* or *Ipomoea*. The galls, which are always concolorous with the stem and become hard and woody in the winter, are elongate, hollow swellings tapering at either end into the stem; they are two or three inches long and may be either straight or spiral; they are found more frequently on climbing vines than on those trailing over the ground. The adult beetles emerge from the galls in the spring and oviposit on the young bindweed during November; the gall is formed by the grub located in the core of the stem. The larvae are full fed in April and May, when they construct a strong and hard cocoon in the bottom of the cavity, in which they hibernate, pupating in spring.

RUTHERFORD (A.). **"Red Slug" of Tea** (*Heterusia cingala*, **Moore**).—*Trop. Agric., Peradeniya*, xliii, no. 2, August 1914, pp. 128–129.

The Zygaenid, *Heterusia cingala*, Moore, the "red slug," is widely distributed in the Ceylon tea districts, where it periodically does much damage. The caterpillar, which is described, is said to feed also on *Lagerstroemia*, etc. The larval life lasts about five weeks, and the imago emerges from the pupa in about 20 days. The moths rest on stems in the hot part of the day and swarm round trees in the afternoon and early evening, when large numbers can be destroyed. The eggs of a parasitic Tachinid are often found attached to the larva.

RUTHERFORD (A.). **Insects Destructive to Dadap** (*Erythrina* **sp.**).—*Trop. Agric., Peradeniya*, xliii, no. 2, August 1914, pp. 129–134.

Short descriptions are given of the most important Lepidoptera, the caterpillars of which defoliate this *Erythrina*, and which can be controlled by an application of lead arsenate to the foliage.

They include *Taragama dorsalis*, Wlk., reported from dadap, tea and siris acacia; *Eupterote geminata*, Wlk., which feeds on grasses, tea, cotton, *Hibiscus* sp. and *Castilloa elastica*; *Eupterote fabia*, Cram., the caterpillars of which cluster at the base of the tree with their heads directed to a common centre; *Orgyia postica*, Wlk., which also feeds on *Eucalyptus* sp., velvet-bean, tea and *Albizzia* in Ceylon, and

on castor in India, and has a wide range in the East; and *Terastia meticulosalis*, Guen., the larva of which bores from the ends of the twigs downwards.

The Pentatomid bug, *Cyclopelta siccifolia*, Westw., feeds in massed colonies on the twigs, rendering its destruction easy; it has also been found on cacao.

HARBORD (G.). **Progress Report of the Experiment Station, Mahailuppama.**—*Trop. Agric., Peradeniya,* xlii, no. 2, August 1914, p. 168.

Two beetle traps, constructed for use on the coconut plantation, one on 21st January and the other on 15th February, were opened on 21st April. About 150 larvae of *Oryctes rhinoceros* in various stages of development were collected from each; most of those in the three-months-old trap appeared to be approaching the pupal stage. These traps serve the double purpose of disposing of coconut rubbish and of facilitating the destruction of large numbers of the larvae.

CORLETT (D. S.). **Progress Report of the Experiment Sta on, Peradeniya.**—*Trop. Agric., Peradeniya,* xliii, no. 2, August 1914, pp. 171–172.

Two traps laid down on the coconut plantation yielded about 100 larvae of *Oryctes rhinoceros* in each. Rough stone or brick walls would be better than logs for constructing traps, the contents of which should be destroyed at least every three months.

FELT (E. P.). *Hormomyia bulla,* sp. n.—*Canadian Entomologist, London, Ont.*, xlvi, no. 8, August 1914, pp. 286–287.

Both sexes are described of this new Cecidomyid which produces subglobular, yellowish galls, about the size of a large pea, on *Helianthus* leaves. The swellings, which appear in July, are equally prominent on both sides of the leaf and are located irregularly, though usually near the mid rib.

DODD (A. P.). **Some Proctotrypoid Egg-parasites of Sugar-cane Insects in Java.**—*Canadian Entomologist, London, Ont.*, xlvi, no. 8, August 1914, pp. 293–294.

Telenomus saccharalis sp. n., is described from material received from Pasoeroean, Java; the eggs, probably those of a Pentatomid bug, from which it was reared, were found on sugar-cane. *Phanarus beneficiens*, Zehnter, was bred from the eggs of *Diatraea striatalis*, as well as from the eggs of an unknown moth on sugar-cane.

Brown-tail Moth control and parasite introduction.—*Agric. Gaz. Canada, Ottawa*, i, no. 8, August 1914, pp. 622–625, 2 figs.

An unusually large flight of females of *Euproctis chrysorrhoea* from the State of Maine, in July 1913, has caused a very considerable increase of the area infested in New Brunswick and Nova Scotia. In

New Brunswick, during the winter of 1913–1914, over 30,000 winter webs, each containing from 100 to 300 caterpillars, were found distributed over eleven counties, as compared with 80 the previous year. In Nova Scotia the figures were 11,000 and 27,000 respectively, and two new counties were found to be infested. The ultimate control of the brown-tail and gipsy moths will only be gained by natural factors. During the past two years Dr. L. O. Howard has permitted the Entomological Branch of the Canadian Department of Agriculture to collect in Massachusetts imported parasites in order to transfer them to New Brunswick and Nova Scotia for colonisation there. A predaceous beetle, *Calosoma sycophanta,* a parasitic fly, *Compsilura concinnata,* and *Apanteles lacteicolor* have now been successfully established in the infested provinces. The chief object of introducing these enemies of the brown-tail and gipsy moths at the present time is to secure their establishment on native insects on which they will feed, as well as on the sparse infestation of brown-tail caterpillars. This will facilitate natural control when the moths become more numerous.

Locusts.—*Agric. Gaz. Canada, Ottawa,* i, no. 8, August 1914, p. 627.

During 1912 and 1913 and in June and July, 1914, locusts have been extremely numerous and destructive in eastern Ontario and parts of Quebec. In 1913 the following poisoned bait proved useful : Bran 20 lb. ; Paris green, 1 lb. ; molasses, 2 qts. ; lemons, 3 ; water, 3½ gallons. The bran and Paris green are mixed dry, and after the juice of the lemons has been added to the water, the molasses is stirred in and the whole liquid added to the poisoned bran. One count gave 414 dead insects in a square yard. Under laboratory conditions the killing power of *Coccobacillus acridiorum* on the Canadian species of grasshoppers was freely demonstrated both in 1913 and 1914. Adverse climatic and other conditions militated against the success of the previous experiments under field conditions and further trials are being made.

Ewing (H. E.). **The Common Red Spider or Spider Mite.**—*Oregon Agric. Expt. Sta., Corvallis,* Bull. 121, August 1914, 95 pp., 5 pls., 30 figs., 14 tables.

In the introduction to this lengthy and well illustrated bulletin the author suggests the name "Spider Mites" for the Tetranychidae instead of the old popular one, "red spiders." He considers that *Tetranychus telarius,* L., *T. bimaculatus,* Harv., and *T. gloveri,* Banks, should be regarded as synonymous, and *T. sexmaculatus,* Riley, as only a variety of *T. telarius.* Under Oregon conditions, the incubation period is about 6 days, and varies greatly with the temperature ; dormant winter-eggs of *T. telarius* are never found out of doors as in the case of the citrus spider mite, *T. mytilaspidis,* or the brown mite, *Bryobia pratensis* ; the incubation period appears to be the same in both fertilised and unfertilised eggs. The larva soon begins to feed, remaining near the spot where it has hatched and does not appear to spin a web, though frequently found on those spun

by the adults. The habits of the protonymphs are similar to those of the larva, and they are very active feeders, while the deutonymphs only differ in being able to spin webs. The adult stage during early autumn lasts about 21 days, but the length of this stage depends chiefly upon the temperature and in hibernating forms may extend over six or seven months. The web is frequently used for attachment of the eggs and also serves as a partial protection from natural enemies; perhaps its most important function is to facilitate travel from one plant to another, and it probably assists in dispersion by high winds.

With regard to the phenomenon of parthenogenesis in this species two experiments are described, from which it appears that unfertilised females always produce males, but whether all fertilised eggs produce females is uncertain. The remarkable degree of colour variation in these mites is not considered to be of specific value. The distribution, both geographical [see this *Review*, Ser. A, iii, p. 13], and according to host, is given in detail with a list of host plants, of which those most infested in the United States are: roses, hops, beans, violets, cotton, strawberry and tomato. The mites will not thrive on: black walnut, nasturtium, radish and wandering jew [*Saxifraga sarmentosa*]. Some of the more hirsute plants are also protected from their attack. The nature of injury done to the more important plants is described.

Besides the natural enemies mentioned by Quayle and McGregor [see this *Review*, Ser. A, i, pp. 143 and 353], the mite *Seius pomi*, Parrott, the Neuroptera, *Hemerobius pacificus*, Banks, and *Chrysopa rufilabris*, Burm., and undetermined Syrphid larvae are also recorded. Included as probable enemies are: the mites, *Anystis agilis*, Banks, *Rhyncholophus gracilipes*, Banks, the moth *Tineola biselliella*, Hummd., and the Coccinellids *Cycloneda sanguinea*, L., *Olla abdominalis*, Say, and *Smilia misella*, Lec.

In taking preventive measures against these mites, useless host plants, especially those that remain green during the winter, should be destroyed. Clean culture is important, and will usually prevent serious infestation. Crop rotation promises good results in certain instances, though care should be exercised in selecting a crop that either matures early before serious mite attacks, or is resistant to them. Trap crops, banding and irrigation are of questionable value. Fumigation is not effective, probably owing to a general resistance of arachnids to poisonous gases, correlated with the difference in their system of respiration. Spraying, while it will kill a large percentage of the mites if properly done, will not give as satisfactory results as with most insects. Nicotine and emulsion sprays are preferable to the sulphur and lime-sulphur sprays. The free use of water as a spray is to be recommended, as it detaches many mites from the leaves and so injures them that they cannot return, besides lowering the temperature and thus reducing the rate of reproduction. It also checks migration and favours the multiplication of predaceous enemies.

This bulletin, which concludes with a bibliography of over 60 references, dating from 1761, is one of the most complete works on this pest.

HOPE (G. D.). The cultivation of tea in Trans-Caucasian Russia.—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta,* 1914, part 3, pp. 77–92.

The caterpillar of *Agrotis ypsilon* (*suffusa*), a cutworm, damages the stems of young tea plants in Trans-Caucasian Russia. A mole-cricket attacks the seedlings, and boring caterpillars do considerable damage.

ANDREWS (E. A.). A new caterpillar pest of tea.—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta,* 1914, part 3, pp. 113–114.

Delias aglaia, L., is a very common butterfly in the tea districts, but its larva has not previously been recorded as attacking tea, and in the case now reported from Assam the injury was slight.

A pest of stored tea dust.—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta,* 1914, part 3, p. 114.

On opening an airtight sample tin of tea, the tea-dust it contained was found to be infested with minute white insects which burrowed on being disturbed. They belong to the family PSOCIDAE, sub-family ATROPINAE, and seemed to be feeding on the tea, but are probably of little importance.

Proclamation declaring *Xyleborus fornicatus* to be a pest in Ceylon.—*Ceylon Government Gazette,* 23rd October 1914.

By proclamation of the Governor dated 16th October 1914, *Xyleborus fornicatus*, Eich., the Shot-hole Borer of tea, is declared to be an insect pest within the meaning of "The Insect Pest and Quarantine Ordinance No. 5, of 1901."

The presence, or supposed presence of the pest must be notified in writing to the Director of Agriculture, who shall have right of entry in person or by agents to verify or otherwise. A register of infested estates and gardens is to be kept by the Department. If the pest be found, the estate or gardens shall be placed in quarantine. No plants or parts of plants, other than leaf for manufacture or tea seed, shall be removed from a quarantined garden or estate, except under permit, nor shall any such plants be shipped or offered for shipment, or carriage by any common carrier, unless the nature of the contents of the bale, case, or package be clearly marked thereon with the estate or garden where same was grown and the name and address of the shipper, owner and consignee.

SCHOYEN (W. M.). Skadeinsekter i frø-og plantsenger. [Injurious insects in seed-beds and nurseries.]—*Tidskrift for Skogbruk, Christiania,* 1914, pp. 448–459, 9 figs.

This is a short treatise on insects attacking the seed beds and nurseries of forest trees in Sweden. *Harpalus ruficornis*, F., attacks the young plants and the seeds and other CARABIDAE, not identified, on one occasion devoured several thousands of pine seeds. Elaterid

beetles and their larvae often destroy the young plants, the former cutting through the stems of two-year-old fir trees and devouring the shoots of four to six year pine trees, while the larvae attack the seeds, roots and stems of young plants of oak, beech, pine and fir.

In the southern part of the country the larvae of *Melolontha* are the most serious pest. The females must be prevented from ovipositing in the nurseries; loose, broken soil, which they prefer, must be avoided and the beds should be protected by a covering of moss or pine needles between the rows. Against the pine weevil, *Hylobius abietis*, which gnaws the bark of the young trees, the following remedies are recommended:—In forests bordering on tracts which are to be planted, it is necessary to remove the bark from the roots of the felled trees in order to prevent the beetles from breeding there, or else to give the areas a rest of three years before planting. As the beetles seldom make use of their wings, trenches, 1 foot deep, are useful in order to collect them and prevent their spread. *Pissodes notatus* destroys not only four to six year old fir plants, but also older trees. As this weevil breeds chiefly in unhealthy trees, all these should be removed and burnt before the larvae have completed their metamorphosis. *Hylastes ater* also attacks the young fir trees, and should be controlled in the same way as the pine weevil. The caterpillars of *Euxoa* (*Agrotis*) *segetum* and *E. tritici* attack yearling plants of pine and fir.

V. A. **Стеблевая совка въ Харьковской губерніи въ 1914 г.** [*Oria musculosa* in the government of Charkov in 1914.]—**« Бюллетень о вредителяхъ Сельскаго Хозяйства и мѣрахъ борьбы съ ними.»** [*Bulletin on Pests of Agriculture and Methods of fighting them.*] Published by the Entomological and Phytopathological Bureau of the Zemstvo of the govt. of Charkov, *Charkov*, no. 5, October 1914, pp. 18–19.

A table is given showing that no less than 37,500 acres, in 11 villages of one district in the government of Charkov, were infested with *Oria* (*Tapinostola*) *musculosa*. If no control measures are undertaken, this pest may spread next year over a much larger area.

Averin (V. G.). **Осеннія работы по борьбѣ съ вредными насѣкомыми.** [Autumn work in the fight against injurious insects.]—**« Бюллетень о вредителяхъ Сельскаго Хозяйства и мѣрахъ борьбы съ ними.»** [*Bulletin on Pests of Agriculture and Methods of fighting them.*] *Charkov*, no. 5, October 1914, pp. 19–20.

The measures which should be undertaken in orchards and market-gardens in autumn against various pests are described. In localities, where injury by *Gryllotalapa gryllotalpa* has been observed, holes of from 1½ to 2 feet square and of the same depth, filled with dung and covered with earth, are recommended. The insects will collect in these, and as soon as frosts set in, the holes must be opened and the dung scattered about. As regards the pests of fruit trees, such as *Anthonomus pomorum*, *Rhynchites pauxillus*, *Cydia pomonella* and *Byturus tomentosus*, the recommendations include collecting and burning fallen leaves, etc.; cleaning the bark and smearing it with

lime and iron sulphate; digging the soil underneath the trees; and spraying with iron sulphate (1 lb. in about $2\frac{3}{4}$ gallons of water, to which from 1 to 2 lb. of lime may be added). With regard to pests of grain crops, ploughing trenches round infested patches and the scattering of large leaves over spots attacked by the caterpillars of *Euxoa segetum*, in order to facilitate handpicking, is suggested. Deep ploughing and the destruction of weeds in or near fields attacked by *Oria musculosa* are strongly advised.

Averin (V. G.). **Свѣдѣнія о появленіи и дѣятельности вредныхъ насѣкомыхъ за іюнь—сентябрь.** [Information as to the appearance and activity of injurious insects during June—September.] —**«Бюллетень о вредителяхъ Сельскаго Хозяйства и мѣрахъ борьбы съ ними.»**—[*Bulletin on Pests of Agriculture and Methods of fighting them.*] *Charkov*, no. 5, October 1914, pp. 21–22.

The following pests were reported during the period from June to September from various parts of Charkov. Various larvae, especially those of the beetle *Baris chloris*, F., have done considerable damage to transplanted cabbages. *Anisoplia austriaca*, Herbst, has appeared in large numbers damaging winter and summer-sown wheat, also winter-sown rye. An outbreak of this pest may be expected next year. *Lema melanopa*, L., has injured oats, barley and winter-sown wheat in one district. Cabbages, beetroots, and summer-sown wheat were attacked in different places by *Agriotes* sp., while beetroots have also suffered considerably from *Bothynoderes* (*Cleonus*) *punctiventris*, Germ., in some districts and from *Cassida nebulosa*, L., in another. Outbreaks of *Melolontha hippocastani*, F., occurred in several parts and more or less damage was done both by imagines and larvae. *Byturus tomentosus*, F., was reported from one district. In the western parts of the government, outbreaks of *Plutella maculipennis*, Crt., (*cruciferarum*, Zell.) were observed. *Phlyctaenodes* (*Eurycreon*) *sticticalis*, L., appeared locally and only in small numbers, except in one district, where it was necessary to spray against it. Winter-sown crops were damaged in some districts by *Euxoa segetum*, Schiff., and rape and mustard by *Athalia spinarum*, F. In one forest the second generation of the larvae of *Lophyrus pini*, L., were injurious. The report mentions also *Lyonetia clerkella*, as having mined nearly all the leaves of cherry-trees in one orchard; the Carabid beetle, *Harpalus calceatus*, L., was swarming round street lamps in June, and a large swarm of *Locusta* (*Pachytylus*) *migratoria*, L., was observed at 10 p.m. on 22nd July.

Областное Энтомологнческое Совѣщаніе 20-21 сентября въ г. Харьковѣ. [The (Provincial) Entomological Conference on 20–21 September (2–3 October) in Charkov.]—**«Бюллетень о вредителяхъ Сельскаго Хозяйства и мѣрахъ борьбы съ ними.»** [*Bulletin on Pests of Agriculture and Methods of fighting them.*] *Charkov*, no. 5, October 1914, pp. 30–32.

At a Conference convened by the Zemstvo of Charkov, the expenses of which were defrayed by the Department of Agriculture, nearly all parts of Russia were represented. Various questions connected with control measures in 1915 were discussed and the possibility of lack of

sprayers and insecticides owing to the war considered. The Conference decided to approach the Department of Agriculture with a proposition that the latter should take upon itself to ascertain the supplies of these articles available in Russia and the possibility of their importation from abroad. The Department should also be asked to afford assistance to national manufactures as far as practicable. Experiments with chromium compounds and potassium permanganate were suggested. With regard to methods of controlling *Oria musculosa*, the conference adopted the following recommendations :—The destruction of stubbles, weeds, etc ; an increase in the area of black fallow land, and of plants to be ploughed in as green manure on fallows, as well as of crops immune to this pest ; at an early stage of infestation the fields must be reploughed and resown with some immune crop ; if the damage is done later when the plants can serve as green food, they should be mown, and, according to the amount of infestation, either burnt or used as food for cattle, the fields being reploughed for black fallow ; experiments in trapping with molasses must be further tested.

The Conference also suggested that the Bulletins of the Charkov Zemstvo should contain monthly information from various stations and Bureaux, owing to the absence of a corresponding monthly journal.

LOCHHEAD (W.). **Principal insects of the season in Quebec.**—*Agric. Gaz. Canada, Ottawa*, i, no. 10, October 1914, pp. 801–804, 3 figs.

The season has been a normal one and few insects have been present in large numbers. The green apple aphis, *Aphis pomi*, did considerable damage where control was neglected. Early in the season, plums were attacked by the plum aphis, *Aphis prunifolii*, but this decreased materially later. Leaf-hoppers on the apple were abundant, but not formidable. The grape-vine leaf-hopper, *Typhlocyba comes*, the chief insect pest of the grape in Quebec, was present as usual in large numbers. The buffalo tree-hopper, *Ceresa bubalus*, and the tarnished plant-bug, *Lygus pratensis*, were numerous. The pea aphis, *Siphonophora pisi*, has done much damage. Cutworms were injurious in several districts, especially the red-backed cutworm, *Euxoa ochrogaster*. The army worm, *Cirphis* (*Leucania*) *unipuncta*, appeared in destructive numbers in Pontiac county in July, but losses were not great owing to the energetic action taken. The diamond-back moth, *Plutella maculipennis*, increased on turnips and did some damage. Tent caterpillars were present in numbers, which though formidable, were much less than those of last year. The ravages of a bacterial disease as well as of dipterous and hymenopterous parasites ensure normal numbers next season. The bud-worm, *Eucosma ocellana*, was kept under by several parasites of which the most important was *Trichogramma pretiosum* (*Pentarthron minutum*), which destroyed over seventy-five per cent. of the eggs. The cigar case-bearer, *Coleophora fletcherella*, was very abundant on currants and gooseberries, where spraying was neglected. *Hylemyia antiqua* and *Chortophila brassicae*, as well as *Chortophila* (*Phorbia*) *fusciceps*, which attacked turnips last year, were all present, but did not do serious damage. The turnip flea-beetle, *Phyllotreta vittata*, and the wavy-striped flea-beetle, *P. sinuata*, were common on crucifers early in the season.

Later, *Systena hudsonias*, was abundant on a number of wild plants as well as on clover, potatoes, etc. The raspberry cane-borer has been abundant and a large number of canes of both wild and cultivated raspberries and blackberries have been killed by its egg punctures. The currant saw-fly, *Pteronus ribesi*, was injurious to both wild and cultivated currants, as well as to gooseberries. The clover-seed Chalcid, *Bruchophagus funebris*, which was observed last year for the first time and did considerable damage to the seed crop, was again present and a large percentage of developing seed was destroyed.

HEWITT (C. G.). **The loss from insect pests in Canada.**—*Agric. Gaz. Canada, Ottawa*, i, no. 10, October 1914, p. 765.

At a conservative estimate, the annual loss from insect pests in Canada is considerably over £20,000,000, a very great proportion of which could be prevented, even with our present limited knowledge of control methods.

BRITTAIN (W. H.). **Pests of the year in Nova Scotia.**—*Agric. Gaz. Canada, Ottawa*, i, no. 10, October 1914, pp. 795–797.

When the San José scale, *Aspidiotus perniciosus*, was discovered in Nova Scotia some of the infestations were of several years standing. Every orchard was inspected and all trees found infested with scale were destroyed. In 1912, 723 such trees were destroyed; in 1913, 57; and in 1914, only 3. The brown-tail moth, *Euproctis chrysorrhoea*, is kept well within bounds by the measures being taken against it. The codling moth, *Cydia pomonella*, though present everywhere, is rarely injurious, as its control is efficient. Other orchard insects that are usually present are: green fruit worms, *Xylina* spp., bud-moth, *Eucosma* (*Tmetocera*) *ocellana*, the green apple aphis, *Aphis pomi*, the rosy apple aphis, *A. sorbi*, the oyster-shell scale, *Lepidosaphes ulmi*, and the canker worm, *Alsophila pometaria*. None of these, however, has been unusually abundant during the season under review, and the measures taken against them have usually proved effective. Several species of CAPSIDAE have been unusually numerous locally and have done some damage. In some localities the tent caterpillars, *Malacosoma americana* and *M. disstria*, were very abundant and wrought havoc in unsprayed orchards. The apple maggot, *Rhagoletis pomonella*, has only become established to the west of the main fruit-growing district and the infestation has only been equal to about one-tenth of that of the previous year. The cabbage maggot, *Chortophila* (*Pegomyia*) *brassicae*, and the onion maggot, *Hylemyia antiqua* (*Pegomyia ceparum*), have not done so much harm as in previous years. The carrot rust fly, *Psila rosae*, usually very injurious, has been little in evidence. An unusual outbreak of the potato stalk-borer, *Hydroecia micacea*, did considerable injury to rhubarb at the Agricultural College Farm. Among grain insects the wheat-midge, *Contarinia* (*Diplosis*) *tritici*, has been fairly abundant and injurious. Like most parts of eastern North America, Nova Scotia was visited by a plague of army worms, *Cirphis* (*Leucania*) *unipuncta*, which

did much damage in spite of all efforts of control. Interest in practical control measures is growing and more than 100 new power spraying-outfits were purchased by the apple-growers of the Annapolis Valley during the season.

MOORHOUSE (H. J.). **Insect pests of the year in Manitoba.**—*Agric. Gaz. Canada, Ottawa*, i, no. 10, October 1914, pp. 809–812.

Manitoba on the whole has been freer than usual from insect pests, though a few species did considerable damage. Cutworms, especially the red-backed cutworm, *Euxoa ochrogaster*, were unusually destructive to oats and barley in one locality. At Morden, the spring canker-worm, *Paleacrita vernata*, was found associated with the fall canker-worm, *Alsophila pometaria*, but elsewhere the latter alone was the cause of damage. Leaf-hoppers, presumably *Empoasca* sp., were very plentiful both on trees and in grain fields during the dry June. The red turnip beetle, *Entomoscelis adonidis*, was common on wild Cruciferae in various places. Among forest insects, the larch sawfly, *Nematus erichsoni*, and the spruce sawfly have continued their ravages. In certain districts there was a somewhat damaging outbreak of the wheat-stem sawfly, *Cephus occidentalis*. In a few instances the loss probably exceeded thirty per cent., but this was only on the edges of the fields where the flies had emerged and flown from the previous year's stubble. Loss from this pest seems generally to have passed unnoticed or to have been credited to other agencies, such as the wind or Hessian fly. Wheat was injured to some slight extent early in the season by wheat-stem maggots, *Meromyza* and *Oscinis* spp. White grubs, *Lachnosterna* spp., likewise attacked cereals rather more extensively than usual.

WILLING (T. N.). **Principal recent insect injuries in Saskatchewan.**—*Agric. Gaz. Canada, Ottawa*, i, no. 10, October 1914, pp. 812–814.

In the early summer, cutworms were troublesome, including *Euxoa ochrogaster*, Gn., *Sidemia* (*Hadena*) *devastatrix*, Br., *Euxoa* (*Chorizagrotis*) *auxiliaris*, Grt., and other species. Caterpillars of *Autographa* and *Phytometra* (*Plusia*) have been more prevalent and moths of six species were taken at night. The imported cabbage-worm, *Pontia rapae*, L., and the diamond-backed moth, *Plutella maculipennis*, Curt., were found in gardens, but not in excessive numbers. There were numerous complaints of cabbage maggots, *Chortophila* (*Pegomyia*) *brassicae*, and also of maggots affecting onions. Leguminous plants have suffered from the attacks of blister beetles in large numbers, *Cantharis nuttalli*, Say, being the commonest, though the smaller *Macrobasis unicolor*, Kby., which frequently attacks the potato, was found in abundance at the beginning of July. Reports of the beet web-worm, *Phlyctaenodes* (*Loxostege*) *sticticalis*, L., were received from various parts of the province. This insect is a general feeder when abundant. Many poplar trees about Saskatoon have suffered from the attack of a dark-coloured aphid, probably a species of *Chaitophorus*. In some instances spraying with kerosene emulsion diluted with water was effective against it.

Harcourt (G.). **Injuries caused by insects in Alberta.**—*Agric. Gaz. Canada, Ottawa*, i, no. 10, October 1914, p. 815.

Cutworms, especially *Euxoa ochrogaster*, have caused severe loss this year. Other pests are the cabbage root maggot, *Chortophila brassicae*, and the onion root maggot, *Hylemyia antiqua*. The former has been successfully controlled by placing tar-paper disks around the roots of the plant, and the latter has not done much damage where sawdust soaked in coal-oil was spread over the ground between the rows, and hoed in.

Eastham (J. W.). **Beneficial insects in British Columbia.**—*Agric. Gaz. Canada, Ottawa*, i, no. 10, October 1914, p. 818.

In June 1913, the army worm, *Cirphis* (*Heliophila*) *unipuncta* did considerable damage in the vicinity of Grand Forks, B.C. Most of the larvae, however, were parasitised by a Braconid, with the result that very few moths emerged and the second brood was of little consequence.

In June 1914, the Alfalfa Plusia, *Phytometra* (*Plusia*) *californica*, was very abundant in various parts of Okanagan, injuring lucerne and garden truck. In orchards where lucerne was growing, the larvae also attacked the apple trees and did considerable injury to both foliage and fruit. The pest, however, was checked before the production of a second brood, in the upper Okanagan chiefly by a Tachinid parasite and a bacterial disease, and elsewhere by a Braconid.

Brittain (W. H.). **Provincial entomological legislation: Nova Scotia.**—*Agric. Gaz. Canada, Ottawa*, i, no. 10, October 1914, p. 819.

By regulations passed under the "Injurious Insect, Pest and Disease Act, 1911," the following pests are designated and declared to be subject to the Act:—

The San José Scale, *Aspidiotus perniciosus*; the Brown-tail Moth, *Euproctis chrysorrhoea*; the Gipsy Moth, *Lymantria* (*Porthetria*) *dispar*; the Woolly Aphis, *Schizoneura lanigera*; the Black Knot, *Plowrightia morbosa*; the Aphis Canker, *Nectria ditissima*; the Apple Maggot, *Rhagoletis pomonella*.

Caesar (L.). **Provincial entomological legislation: Ontario.**—*Agric. Gaz. Canada, Ottawa*, i, no. 10, October 1914, pp. 820-821.

The legislation in regard to insect pests in Ontario is contained in the Act known as the "Fruit Pest Act" and the regulations pertaining thereto. The insects and diseases included in the Act are those which require co-operative action for their thorough control, viz.:—San José Scale, Black Knot, Peach Yellows, Little Peach and Pear Blight. The general enforcement of the provisions of the Act and regulations is entrusted to the Provincial Entomologist assisted by the Provincial Inspector. No person shall sell or dispose of, or offer for sale, any plant taken or sent out from a nursery unless the same has been previously

fumigated by hydrocyanic acid gas in accordance with the regulations. The following plants are exempt from fumigation: evergreens, strawberry plants, bulbs and tubers, herbaceous perennials, and bedding plants.

WINSLOW (R. M.). **The insect pests of the year in British Columbia.**—*Agric. Gaz. Canada, Ottawa*, i, no. 10, October 1914, pp. 817–818.

The green apple aphis, *Aphis pomi*, and the mealy plum aphis *Hyalopterus arundinis*, F., were unusually prevalent in some coast sections. Control by the use of Black Leaf 40, with or without soap, was in most cases successful when properly handled. The bud moth, *Eucosma ocellana*, on apples and cherries, was especially prevalent in the coast sections and was controlled by lead arsenate. A climbing cutworm seriously attacked clover and apple trees. On the latter, sticky fly-paper bands were used on the trunk and the foliage was sprayed with lead arsenate. The cabbage root maggot, *Chortophila brassicae*, was abundant on cruciferous crops and the damage was aggravated by the unusually dry weather. The tar-paper disk method was exceptionally efficient.

GIBSON (A.). **The Burdock Gelechiid. An Insect Seed Destroyer.**—*Ottawa Nat., Ottawa*, xxviii, no. 7, October 1914, p. 96.

Nearly every seed head of *Arctium minus* in the Ottawa district is said to harbour one or more larvae of *Metzneria lappella*, L., during autumn and winter. *M. lappella*, a native of Europe and Asia, was discovered in Canada, at Levis, Quebec, in September 1898, and is supposed to have been introduced there in the burs of *A. minus*, contained in fodder. It has since spread considerably throughout Quebec and Ontario and is abundant at Toronto, where it has been observed since 1904.

Parasol Ants.—*Bull. Dept. Agric. Trinidad & Tobago, Port-of-Spain*, xiii, no. 83, August–October 1914, p. 280.

The Governor of Trinidad and Tobago has declared the parasol ant, *Atta* sp., to be a pest within the meaning of the Plant Protection Ordinance of 1911. An order can now be served on any one having nests of this pest on his land, compelling him to destroy them.

La destruction des noix du coton par le feu. [The destruction of cotton bolls by fire.]—*Bull. Union des Agriculteurs d'Egypte, Cairo*, xii, no. 108, July–October 1914, pp. 247–248.

On the 5th October, the inspectors of the Ministry of Agriculture, now responsible for cotton worm control in Egypt, were instructed to enforce the Khedivial decree relating to the removal of the bolls before the cotton plants were uprooted and their subsequent destruction by fire. The bolls must be removed 15 days before the three dates, 15th October, 15th December, and 31st December, fixed as the time limits for the uprooting, the variation of the dates being according to regions.

Sanford (F.). An Experiment on Killing Tree Scale by Poisoning the Sap of the Tree. [Correspondence.]—*Science, Philadelphia,* **xl, no. 1032, 9th October 1914, pp. 519–520.**

The author having unsuccessfully tried various methods of exterminating *Icerya purchasi* from Spanish broom [*Spartium junceum*] made the following experiment: A $\frac{3}{8}$ inch hole bored in the trunk to a depth of about 3 inches, was filled with crystals of potassium cyanide and plugged. In two days the scale began to fall, and in a few days all appeared dead; the tree has since been vigorous and free from scale. A similar charge of potassium cyanide was placed in a scale-infested peach tree, which revived and produced a fair crop, the fruit being unharmed by the poison; the fruit from an orange tree treated in the same way also appeared to be uninjured. This method should prove useful in the destruction of borers and insects which burrow beneath the bark.

A wood-boring moth.—*Agric. News, Barbados,* xiii, no. 325, **10th October 1914, p. 328.**

The caterpillars of *Duomitus punctifer*, Hamp., have been found boring into the stems of orange and tangerine trees in Nevis. They tunnel in the hard wood, attacking fairly large stems which remain green for a considerable time after the hard wood is practically destroyed, though the whole stem eventually dies. *D. punctifer* occurs in Dominica, St. Lucia, St. Vincent and Grenada. It has also been found attacking camphor, the Nicaragua shade tree (*Gliricidia maculata*), sapodilla (*Achras sapota*), guava, *Pithecolobium saman*, white wood (*Tecoma leucoxylon*), soursop (*Anona muricata*), *Ipomoea* spp., and ornamental crotons (*Codiaeum* spp.). The male moth flies actively and is frequently attracted to light. The female does not fly so readily, at least until after oviposition has taken place. The eggs are laid in or on small twigs through which the newly-hatched larvae tunnel to the larger branches. When the larva is about to pupate, it eats its way towards the surface and leaves a thin diaphragm of bark as a cover to the exit, and pupates at a short distance within the tunnel. The partitions which are built across the tunnels at intervals are a characteristic feature. The tunnels of *D. punctifer* in the smaller branches of the whitewood are often infested by a mealy-bug which sometimes occurs in large numbers.

A new cotton pest.—*Agric. News, Barbados*, xiii, no. 326, 24th October **1914, p. 344.**

Cockroaches are reported to be injuring cotton in St. Kitts. On two estates there, much trouble was experienced in establishing cotton plants in certain fields, as they were several times eaten down when planted. The characteristic feature of these attacks is to be found in the fact that only the seed-leaves are eaten. Any plant which gets through the seed-leaf stage and develops its first foliage-leaf, seems to escape further attack. The insect concerned is the Australian cockroach, *Periplaneta australasiae*, which is the common household cockroach in the West Indies. Individuals so far observed in the fields are all, or nearly all, immature.

Fryer (J. C. F.). **An Insect Harmful to Newly-budded Rose, Apple, and Plum.**—*Jl. Bd. Agric., London*, xxvi, no. 7, October 1914, pp. 636–637.

During the last two years, a small maggot has caused numerous failures in newly-budded rose, apple and plum stocks. In cases of attack, the bud dies, even after it has become partly welded to the stock, and on examination a number of small bright red maggots are found underneath the bud or under the bark of the stock, where the incision has been made. The pest has been provisionally identified as a gall midge, *Clinodiplosis oculiperda*, Rucbs., [see this *Review*, Ser. A, i, p. 424]. In the present paper the use of grafting wax for complete protection of the wound made in the process of budding, is also suggested.

Porritt (G. T.). **Abundance of the Gooseberry Saw-fly,** *Pteronus ribesii*, **Scop.**—*Entom. Mthly. Mag., London*, l, no. 605, October 1914.

Pteronus ribesi is reported to have been unusually abundant in the neighbourhood of Huddersfield. Gooseberry bushes in widely separated districts of the town were defoliated. In one garden larvae of the second brood were hatching at the time that numerous imagines of *Abraxas grossulariata* were depositing their eggs, and by the time the larvae hatched, there was little left for them to feed on.

Borodin (Dm.). **Медвѣдка и борьба съ ней.** [*Gryllotalpa* and the fight against it.]—**«Хуторянинъ.»** [*Chutorianin*], *Poltava*, no. 38, 2nd October 1914, pp. 1051–1055, 4 figs.

Gryllotalpa gryllotalpa (*vulgaris*) is a very dangerous pest of market gardens where the soil is sandy or damp, epecially if near water. These insects winter in rich soil and appear in April. They feed on the larvae of insects to some extent, but mostly on roots and stalks of plants, such as cabbage and other vegetables, also fruit trees, grain crops, and even forest trees. The burrows are usually less than 2 inches deep. Oviposition takes place in May in nests situated deeper than the burrows, from 200 to 350 eggs being deposited in each. The young mature and become winged in the second year. The remedies in spring consist in the use of poisoned maize, which must be placed, as soon as the soil thaws, near the spots attacked in the previous year. Two methods of preparing poisoned maize are given: (1) 10 lb. of maize is boiled in water until it becomes soft, after which the water is poured off and about 2 oz. of white arsenic is added and the whole thoroughly stirred; (2) 1 lb. of white arsenic is dissolved in water and boiled in the open air with 10 lb. of maize until the maize is soft, water being added when necessary. The grain prepared in this way is buried in the earth, at a depth of about 2 inches and at intervals of about 1 foot. In summer the best plan is to sink a number of pots to their edges in the soil at more or less regular intervals and to connect these with boards set on edge and planted an inch or two below the surface. In this way, the ground is divided into a number of small areas with a pot at every angle. When the time for oviposition has

arrived, measures can also be directed against the eggs. In the government of Poltava, oviposition takes place about the 25th May; in Charkov, ten days earlier; in Cherson, at the beginning of May; while in the governments situated to the north of these it does not occur until the end of June. When a burrow is discovered it can be followed to the nest and the eggs destroyed. In autumn, the usual dung traps should be set [see this *Review*, Ser. A, i, p. 496; ii, pp. 42]. Dung-heaps in or near market-gardens should be so placed and arranged that the mole crickets which are certain to breed in them, cannot escape into the garden.

VITKOVSKY (N.). **Шведская мушка, повреждающая озимые всходы.** [*Oscinis frit* injuring seedlings of winter-sown grain.]—**« Южное Хозяйство.»** [*Southern Husbandry*], *Alexandrovsk*, no. 18, 13th October 1914, pp. 642–645, 5 figs.

This article contains a popular account of the life-history of the larvae of *Oscinis* (*Oscinella*) *frit* and of the injuries caused by them to winter-sown crops. The adults oviposit on the leaves of grain crops, on the panicles of oats, and on the ears of wheat. Several generations occur during the summer, and after the harvest they oviposit on germinating grain or on wild Graminaceae, on which they breed until the winter-sown crops appear. The larvae injure the stems, while those emerging from eggs laid on the ears injure the grain; they also attack maize. Winter crops should not be sown before the middle or end of August, and weeds and germinating fallen grain should be destroyed by deep ploughing after the harvest. Rotation of crops should also be practised.

SHAVROV (N.). **Средство противъ личинокъ іюньскаго хруща.** [A remedy against the larvae of *Rhizotrogus solstitialis*.]—**« Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, no. 40, 18th October 1914, p. 1230.

The larvae of *Amphimallus* (*Rhizotrogus*) *solstitialis* are very dangerous in sandy and porous soil. Placing a stratum of clay at the bottom of the hole before planting trees is recommended as affording a protection for the roots.

OL (I.). **Поврежденіе розъ насѣкомыми.** [Injury to roses by insects.]—**« Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, no. 41, 25th October 1914, p. 1261.

In reply to a subscriber, the author says that the pest which injured the shoots of his roses is the sawfly, *Hylotoma rosae*, L., and gives some information on this pest and on remedies against it. The imago appears in May and the females pierce the young shoots with their ovipositors, laying one egg in each wound and smearing it over with a sticky mucilage. The larvae hatch in 8 to 10 days and devour the leaves, with the exception of the veins. In June, they pupate in the earth, producing a second generation in August, the larvae from which

winter in their cocoons in the soil. The chief injury is that done to the shoots by the ovipositing females. The remedies include the removal and burning of the attacked shoots before the larvae hatch, the shaking down of the larvae and spraying with Paris green (1 oz. of green, 2 oz. of freshly slacked lime in 9 gals. water) or with a 2 per cent. solution of barium chloride.

SHAVROV (N.). **Кровяная тля въ Цихидзирѣ.** [*Schizoneura lanigera* in Tzichidzira.]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, no. 41, 25th October 1914, pp. 1262–1263.

On the Caucasian Black Sea littoral, where the rainfall is heavy and the soil poor in lime, the conditions are very unfavourable for the successful control of *Schizoneura lanigera* and most of the European varieties of apples cannot survive its attacks there. Only palliatives can be recommended, such as the removal of injured shoots and the mechanical cleansing of the trunks and roots, as well as spraying and washing with boiling water, kerosene, carbolineum, etc. The safest remedy is to destroy the attacked trees. Apples should not be planted in this locality, or at least only local varieties or Canadian rennets.

GOLOVIANKO (Z.). **Къ вопросу о лѣсохозяйственныхъ мѣрахъ борьбы съ майскими хрущами.** [On the question of forestry measures against *Melolontha*]. *Kiev*, 1914, 16 pp.

Amongst the many remedies suggested against the larvae of *Melolontha*, the greatest importance is attached to those which are of a preventive, rather than of a destructive nature, and which aim at minimising the damage done. It is impossible to recommend any one remedy of this kind which is effective in every country under all conditions. It is first necessary to establish which of the two species, *Melolontha melolontha*, L., (*vulgaris*, F.), or *Melolontha hippocastani*, F., is present, and how far its habits are affected by the local climatic and other conditions. Feddersen was the first to point out the differences in the biology and economic importance of the two species and to show that *M. melolontha* is chiefly a pest of field crops, while *M. hippocastani*, in Prussia and Brandenburg at all events, lives and breeds mostly in forests, though it prefers to oviposit in open places. *M. melolontha* is found only in the south-western part of Russia, the eastern limit of its distribution being a line drawn from the Baltic provinces to Caucasia. *M. hippocastani* is present both to the west and east of this line, from Archangel in the north to Ekaterinoslav in the south, and also in Siberia. Thus the prevalent species in the Russian forests is *M. hippocastani*, not *M. melolontha*. The author's own investigations, conducted from 1909 to 1913 in the governments of Podolia, Kiev and elsewhere, show that *M. hippocastani* prefers sandy soils, and *M. melolontha* heavier and wet, clay soils. Data collected in Podolia confirm the statement that *M. melolontha*, which is found there almost exclusively, is chiefly a field insect, its larvae being absent in the soil of dense plantations and present in great quantities in large

cleared areas, mostly in cultivated fields adjoining forests. In order to control this pest, large clearings in forests must be avoided, and as the soil must not be disturbed in years when the adults are numerous, young trees must be planted without delay on such fresh clearings as are still uninfested. In Kiev, Tchernigov, Voronezh and Samara, *M. hippocastani* is a forest insect and its eggs are most numerous in the soil of dense pine forests. The number of eggs deposited in soil which had been cultivated was considerably less than in undisturbed soil. Felling along narrow lines in the forests should therefore be avoided, but the trees should be cut over large blocks which adjoin each other. Where possible, the cleared areas should be utilised for from one to three years for agricultural purposes, and the soil be well broken up. Re-planting must be effected on thoroughly cultivated soil and the spaces between the planted strips must not be left waste, but should be used for agricultural purposes.

In conclusion, the author compares some of his observations with statements by Feddersen. According to the latter, *M. hippocastani*, in Prussia, oviposits mostly on waste ground and has a five-yearly generation, the first pupae appearing in September and the first beetles in October; the author's observations in Russia show that the insects oviposit mostly in dense plantations and have a four-yearly generation, both the pupae and adults appearing much earlier in the season. These differences can be explained by the different conditions. Thus, while in Samara *M. hippocastani* oviposits mostly in dense woodland, in the neighbouring government of Ufa it mainly infests the soil of large treeless areas. This is due to the difference in the soil, that in Samara being dry and warm on sloping sandy hills, while in Ufa it is wet and cold. In warm, dry soils these insects find the necessary conditions in shady places, while in the colder and wetter soils they select sites exposed to the sun's rays.

HEINRICH (C.). **A New Californian *Coleophora* on Plum.**—*Insecutor Inscitiae Menstruus, Washington, D.C.*, ii, no. 10, October 1914, p. 145.

Coleophora sacramenta, sp. n., is described from Santa Clara, California; it is stated to be destructive to the foliage of cultivated varieties of *Prunus*. The adult moths appear at the end of April.

MACGILLIVRAY (A. D.). **New Genera and Species of Sawflies.**—*Canadian Entomologist, London, Ont.*, xlvi, no. 10, October 1914, pp. 363–367.

This paper includes descriptions of the following new sawflies, some of which are of economic importance; *Simplemphytus pacificus*, gen. et sp. n., from Oregon, where it was reported as boring into the stems of cherry; *Profenusa collaris*, gen. et sp. n., from Boston, Mass., and Ithaca, N.Y., the larvae mining the leaves of *Crataegus*, and from Geneva, N.Y., where the larvae were serious pests, mining the leaves of cherry; *Emura maculata* and *E. minuta*, spp. n., from Ohio and Iowa respectively; and *Metallus bethunei*, sp. n., from Ontario, where it was bred from a leaf-mining larva on blackberry.

Pescott (E. E.). **Orchard and Garden Notes.**—*Jl. Dept. Agric. Victoria, Melbourne,* October 1914, xii. pt. 10, pp. 637–639.

In October, nicotine sprays should be used to combat peach aphis, *Aphis amygdali*, Fons., pear and cherry slug, *Eriocampoides cerasi*, L. Lead arsenate should not be used for the latter if the cherries are within a month of ripening. Tobacco water or hellebore is quite as effective as lead arsenate. The first spraying with lead arsenate for codling moth, *Cydia pomonella*, should be followed by a second, a week or ten days later. A strong tobacco spray will check the rose-aphis, and lead arsenate or Paris green spraying will suppress leaf-rolling and leaf-eating insects.

French (C., Junr.). **Cut Worms.**—[Reprinted and revised from *Jl. Dept. Agric., Victoria,* July 1911, pp. 455–458.] October 1914, pp. 1–13, 2 pls., 3 figs.

There are at least two broods of cutworm moths in a season in Victoria. Poisoned baits [see this *Review*, A, ii, pp. 23-24] have given excellent results, and recent tests have proved the following to be a successful formula: 1 lb. sodium arsenite and 8 lb. treacle or brown sugar dissolved in 10 gals. water and mixed with chopped lucerne or other green stuff; this should be moistened, but not made too wet. Spraying bunches of clover and other succulent vegetation with 2 lb. lead arsenate to 50 gals. water and scattering these on plants liable to attack, has proved successful; for vegetable gardens three or four bushels of finely powdered lime mixed with one bushel of soot and sprinkled around infested plants, is recommended. There are many natural enemies, including insectivorous birds, which check cutworms. The Sphegid, *Ammophila instabilis*, was a valuable destroyer of cutworms in their recent serious attacks in N. Victoria; ground beetles, especially *Calosoma schayeri*, several species of parasitic Hymenoptera, Tachinid flies, ants and a bacterial disease also attack them. In vineyards, two systems have been largely used to protect the vine: spraying with lead arsenate in suspension in water, 3 lb. of arsenate to 50 gals. water, applied when the larvae first hatch out; and the use of poison baits placed close to the young vines, which is a good method when the cutworms appear before the vine foliage. The following formula has given good results: bran 10 lb., molasses 4 lb., Paris green 4 oz., the whole to be made into a paste and scattered in small pieces about the size of a nut close to the young vine. These baits are useless when dried up and should be removed to avoid injuring the soil; in one instance many vines died from arsenical poisoning when this was neglected. The soya bean or other plant readily eaten by cutworms, might be planted on either side of the vines and sprayed. The growing-bait method [see this *Review*, A, i, pp. 513–514] is described.

Wardle (R. A.). **Preliminary Observations upon the Life-histories of *Zenillia pexops*, B. & B., and *Hypamblys albopictus*, Grav.**—*Jl. Econ. Biology, London,* ix, no. 3, October 1914, pp. 85–103, 3 pls., 1 fig. 2 tables.

Investigations during 1913 on the large larch sawfly, *Nematus erichsoni*, Htg., showed a great reduction in the numbers of *Mesoleius*

tenthredinis, Morley, formerly so prevalent, and the occurrence of two previously unrecorded parasites: the Ichneumon, *Hypamblys albopictus*, Grav., and the Tachinid, *Zenillia pexops*, B. & B. *H. albopictus* has a life-history similar to that of *Mesoleius*, and though possibly emerging a few days earlier, it hibernates as a first stage larva. *Z.* (*Myxexorista*) *pexops* hibernates as a final stage larva and forms its puparium within the cocoon of the sawfly, emerging about the same time as the host. The percentage of *Zenillia* appears to vary inversely with that of the Ichneumons, indicating that where superparasitism by the two occurs, the Tachinid conquers the Ichneumon; in the case of superparasitism with *H. albopictus* and *M. tenthredinis*, the former emerging as it does a few days earlier, would probably survive.

Boucher (W. A.). **The Orchard.**—*Jl. Agric., Wellington, N.Z.*, ix, no. 4, October 1914, pp. 286–288.

Where winter spraying against scale-insects has been overlooked, kerosene emulsion applied in the late spring and early summer will readily destroy the young, wandering scales. The percentage of fruit infested by the codling moth will be infinitesimal if a reliable brand of lead arsenate is carefully and thoroughly sprayed, and this will also control the "leaf-roller caterpillar." By adding resin solution to the lead arsenate during the early part of the season when the "bronze beetle" is troublesome, the efficiency of the arsenate against the latter pest will be increased. To prepare the resin solution, 1 lb. of washing soda is dissolved in 2 gallons of boiling water; $1\frac{1}{2}$ lb. of resin is then added and boiling is continued, the mixture being stirred until the resin is dissolved. Care is necessary to prevent the mixture from boiling over, and for this reason the resin solution should be prepared out of doors. For "bronze beetle," add 3 quarts of the solution to 50 gallons of lead arsenate spray.

Allen (W. J.). **Orchard Notes.**—*Agric. Gaz. N. S. W., Sydney*, xxv, pt. 10, October 1914, pp. 914–916.

Apple, pear and quince trees should be sprayed with a high-pressure pump, avoiding the hottest part of the day. Bordeaux mixture, i.e., copper sulphate 6 lb., lime 4 lb., water 50 gals., is suitable for the purpose and may be applied in conjunction with lead arsenate. If lime-sulphur alone is used, the formula, lime 53 lb., sulphur 100 lb., to 50 gals. water, should be applied, using a dilution of 1 part of the concentrated mixture to 28 parts water. Lead arsenate is advised for checking the cherry slug, *Eriocampoides cerasi*, and thorough spraying with tobacco wash and soft soap for the black aphis.

Froggatt (W. W.). **A Descriptive Catalogue of the Scale-Insects (Coccidae) of Australia.**—*Agric. Gaz. N. S. W., Sydney*, xxv, pt. 10, October 1914, pp. 875–884, 1 pl.

The following species of Coccidae are included in this instalment of the catalogue of scale-insects [see this *Review*, A, ii, p. 652, 705]: *Mytilaspis subspiculifera*, sp. n., from the bark of the yarrow, *Exocarpus*

aphylla; *Lepidosaphes* (*Mytilaspis*) *spinosa*, Full., from *Melaleuca* sp., *Poliaspis casuarinae*, Lidgett, from *Casuarina suberosa*; *P. exocarpi*, Mask., from various plants, including *Exocarpus cupressiformis*; *P. intermedia*, Full., from a "Leguminous plant"; *Diaspis boisduvalii*, Sign., from acacias and palms in New Zealand, and orchids in South Australia; *D. bromeliae*, Kerner, from pineapples; *Aulacaspis* (*Diaspis*) *pentagona*, Targ., attacks the mulberry in Japan and Italy, garden plants, especially geraniums, in Ceylon, papaws in Trinidad, and has been found on cherry, plum, apricot, peach, grapes, etc.; *A. rosae*, Bouché, which attacks rose, myrtle, pear, mango, ailanthus and cycas, and also infests blackberries in New Zealand, has a world-wide range, with the exception of Africa. *Fiorinia acaciae*, Mask., from acacias; *F. casuarianae*, Mask., from the under surface of the foliage of *Casuarina* sp., *Leucaspis cordylinidis*, Mask., from *Cordyline*.

Barker (A. H.). **The Banding of Fruit Trees.**—*Gardeners' Chron., London*, lvi, no. 1451, 17th October 1914, p. 266, 1 fig.

The results of experiments in banding, carried out on about 50 trees during two successive winters, are given. The trees selected comprised apple, plum, damson and filbert, with one or two forest trees. By the first series of bandings, which lasted from early September to the end of February, *Cheimatobia brumata* was caught in large numbers, especially at the end of October. The bands were generally placed 1 ft. apart, the lowest being just off the ground, and were changed weekly in some cases, monthly in others. The majority of moths caught were on those bands about 5 or 6 ft. from the ground; next in usefulness seemed to be those at the base, proving conclusively that many females begin to crawl straight from the ground. Bands of various widths were used and it was noted that most moths, especially *Hybernia defoliaria*, could cross bands of 4 ins. or less, while not one could cross a 12 in. band, 10 ins. being the narrowest that was effective. The American preparation proved superior to the English in every case, as regards the numbers of moths it caught; it also seldom required renewing. The comparative failure of the English preparation is believed to be due to its thin consistency. A little treacle mixed with the grease seemed to increase its attraction for the males; the butter parchments used by grocers make good bands, one sheet making two wide bands.

Webb, (T. C., Junr.). **Tomato-culture.**—*Jl. Agric., Wellington, N.Z.*, ix, no. 4, October 1914, pp. 255–261.

Whitefly, *Aleurodes nubifera*, caused some damage in 1913, but was easily eradicated by the use of MacDougall's fumers. In 1914 there was very little sign of this pest. For the control of insect pests, and especially the tomato-caterpillar, which often causes serious loss in the case of outdoor-grown tomatoes, arsenate of lead was used in conjunction with Bordeaux mixture, at the rate of $1\frac{1}{4}$ lb. to 40 gallons, with good results.

Kusnetzov (A.). **Одна изъ причинъ усыханія плодовыхъ деревьевъ. (О садовомъ червецѣ).** [One of the causes of the withering of fruit-trees:—the orchard species of Coccids.]—**«Южное Хозяйство.»** [*Southern Husbandry*], *Alexandrovsk*, no. 14, 13th August 1914, pp. 505–537. [Received 4th January 1915].

The author calls attention to the so-called orchard or apple Coccid, [probably *Lepidosaphes ulmi* (*Mytilaspis pomorum*)], which is frequently responsible for the withering of fruit trees; trees attacked by these pests have their growth arrested, and become seriously affected in from 2 to 3 years. Smearing the trees early in spring with California mixture, consisting of 10 lb. of sulphur and 10 lb. of quicklime in 27 gallons of water, is recommended; other remedies are spraying with kerosene emulsion, consisting of 2 lb. of green soap and 12 lb. of kerosene in about 32 gallons of water, or with 5 per cent. kerosene water three times at intervals of 1 or 2 days; the spraying must be done at the time when the larvae are emerging.

Knab (F.) & Yothers (W. W.). **Papaya Fruit Fly.**—*Jl. Agric. Research, Washington, D.C.*, ii, no. 6, September 1914, pp. 447–453, 2 pls. [Received 19th January 1914.]

Since 1905, when the fruit of the papaw (*Carica papaya*, L.) in Florida, was found infested with the maggots of *Toxotrypana curvicauda*, the economic importance of this crop has developed. Hooker has reported the occurrence of this pest in Porto Rico [see this *Review*, Ser. A, i, p. 390], and it seems to have a very wide distribution in tropical America, probably co-extensive with its food-plant. The egg, larva, puparium and adult are described. Under the conditions observed, viz., on bright, nearly cloudless days, the flies only fly and oviposit for about 15 or 20 minutes just before sunset, but there may also be a morning flight. The female oviposits on well-developed, but green fruits, and evidently tries to reach the central seed chamber with her ovipositor. Cultivated forms of papaw having the thickest flesh were for this reason far less infested than the smaller wild fruit. With the exception of mature individuals in ripe fruit, the larvae are always found in the seed mass. It is only when they are full-grown or nearly so that they enter the flesh. They then work their way out and drop to the ground in order to pupate at a depth of 1 or 2 inches below the surface of the soil. According to C. A. Mosier, more females are on the wing on dark cloudy days, while the males are active and predominate on warm sunny days. Deformed fruits are said not to be attacked. The restriction of this fly to the papaw is confirmed. The production of varieties with thick flesh and which ripen slowly and the destruction of adventitious or wild plants and of all infested fruits are recommended.

Kelly (E. O. G.). **A New Sarcophagid Parasite of Grasshopers.**—*Jl. Agric. Research, Washington, D.C.*, ii, no. 6, September 1914 pp. 435–445, 1 pl. [Received 19th January 1914.]

In July 1912, an example of *Melanoplus differentialis* was captured as it was being struck by flies, though no eggs could be found on it. The grasshopper and four others which had been similarly attacked were caged and these died in a few days. Full-grown maggots issued

from these dead grasshoppers on 10th August, pupated from the 12th to 14th, and adult flies emerged on 26th August. These belonged to several species, one of which, *Sarcophaga kellyi*, has been described as new by Dr. J. M. Aldrich, whose description is appended to this paper. Dissection of attacked grasshoppers revealed several small maggots in the viscera of the thorax and abdomen, and also under the scutellum. Further investigations showed this species of *Sarcophaga* to be viviparous, and that minute larvae are deposited by the parent fly on the underside of the unfolded posterior wings of the flying grasshopper, the striking of the wing by the fly probably causing the sudden dropping of the victim.

A large species, *Schistocerca americana*, Drury, was captured, and when it attempted to fly while being held by its hind legs, it was at once struck on the underside of the unfolded wing by several Sarcophagid flies. This experiment was repeated with several individuals of *Melanoplus atlantis*, Riley, and *M. femur-rubrum*, De Geer, and on 32 specimens the maggots were found on the underside of the unfolded wing, with a few scattered promiscuously on the abdominal segments; an examination of 75 individuals of *M. bivittatus* gave similar results. The larvae grow rapidly, and having matured in from 10 to 30 days, pupate in the soil at a depth of from 2 to 6 inches; while most frequently found beneath the dead host, they have sometimes been observed to crawl a distance of 40 inches before entering the soil. The Sarcophagids often seemed unable to distinguish grasshoppers from other insects and were observed to strike moths and butterflies and deposit larvae upon them, but attempts to rear the flies from Lepidoptera so attacked were unsuccessful. In July 1913, nymphs of *M. differentialis* and *M. bivittatus* were very plentiful and afforded ample material for study; adults of *S. kellyi* frequently deposited larvae on the nymphs in the second, third and fourth instars as they hopped about, but in no instance was a fly observed attacking those not in motion. H. E. Smith, who observed flies attacking nymphs of *Dissosteira longipennis*, Thos., during a severe outbreak of this species at Elida, New Mexico, found that they deposited larvae on soft, freshly emerged individuals which were crawling about the vegetation. During a serious outbreak of grasshoppers, which occurred in the vicinity of Wellston, Oklahoma, early in June 1913, the prevalent species being *Melanoplus differentialis*, *M. bivittatus*, and *M. atlantis*, with a few individuals of other species, very large numbers were parasitised by Sarcophagids and eventually were practically controlled by them.

In the course of further experiments with Sarcophagids, *S. kellyi*, *S. cimbicis*, Towns., *S. hunteri*, Hough, and *S. sarraceniae*, Riley, were observed attacking adults and nymphs of *Chortophaga viridifasciata*, De Geer, which hibernates in the nymphal stages, and also the larger nymphs of *M. differentialis* and *M. bivittatus*, which were less common. It is probable that there are five or six generations of these species in the season. Other species of *Sarcophaga* known to parasitise grasshoppers, are *S. sinuata*, Meig., and *S. helicis*, Towns. The Chalcids, *Perilampus hyalinus*, Say, *Chalcis coloradensis*, Cress., *Aphaereta* sp., and *Eupteromalus* sp., have all been reared from the puparia of *Sarcophaga*, but to what extent these parasites affect the efficiency of the flies cannot be estimated.

RUTHERFORD (A.). **Insects pests of some leguminous plants.**—*Trop. Agric., Peradeniya*, xliii, no. 4, October 1914, pp. 319–323.

Aulacaspis pentagona, Targ., previously found in Ceylon on various plants, has been noticed on *Crotalaria striata* and on a bean plant. On *Flacourtia*, this Coccid is attacked by the Coccinellid, *Chilocorus circumdatus*, by a small brown Coccinellid with Pseudococcus-like larvae, by a minute black Coccinellid probably of the genus *Cybocephalus*, by a small black Chalcid, and by the larvae of a Cecidomyid. *Hemichionaspis minor*, Mask., which occurs in Ceylon on species of *Crotalaria* and other plants, seems much less common than its near ally, *H. aspidistrae*, Sign., which is often very injurious to such palms as coconut and *Areca chrysalidocarpus*. It is partly kept in check by Coccinellids, Chalcids and Cecidomyids. *Lepidoaphes ?gloveri*, Pack., occurs on *Crotalaria* and on orange trees. A Membracid, *Leptocentrus ?substitutus*, also feeds on *Crotalaria*. The eggs of these insects, which are deposited underneath the bark of the stem and of the leaf-stalks, are subject to the attack of minute Hymenopterous parasites. The Capsid *Ragmus importunitas*, Dist., has recently been injuring *Crotalaria* at the Experiment Station, Peradeniya, and a dark green aphis is also occasionally found on it. The best application against these sucking insects is kerosene emulsion. Aphids, however, are so much subject to the attacks of natural enemies, especially Syrphid larvae, in Ceylon, that generally nothing requires to be done against them. In the case of *Aulacaspis pentagona* and *Hemichionaspis minor*, unless a large number of plants are attacked, it is best to cut out and burn the infested ones. In other cases the stems should be rubbed with a coarse brush before the spray is applied. A small Dipterous larva, probably an Agromyzid, attacks the stems of *Crotalaria striata* at Peradeniya. It is probably not very injurious in Ceylon at present, but should not be neglected, and all badly attacked plants should be burned. *Crotalaria* is subject to defoliation by the caterpillar of *Argina ?syringa*. When not numerous, the caterpillars should be collected. Lead arsenate or Paris green should be used against large numbers. The seeds of *Crotalaria* are liable to be destroyed by a Tineid caterpillar which lives inside the pods. In April, branches of *Tephrosia candida* were received heavily infested with mealy bug, probably *Pseudococcus virgatus*, Ckll. Among the insects sent in on Tephrosia was the pupa of the Lycaenid *Spalgis epius*, the caterpillar of which usually keeps this group of Coccids in check in Ceylon. In May, a branch of *T. candida* was received infested with a species of *Cerococcus* closely agreeing with *Cerococcus hibisci*, Gr. On the same twigs nymphs and adults of a Membracid, probably *Gargara mixta*, were feeding. *Xyleborus ?fornicatus*, was received with the report that it was causing the stem of *Tephrosia* to break off just as in the case of tea. Some of the beetles were slightly smaller than typical *X. fornicatus*. A large colony of *Aspidiotus lataniae*, Sign., was observed on the stem of a plant of *Leucaena glauca* growing as shade among *Coffea robusta*. A species of *Xyleborus* (prob. *X. fornicatus*) was recently observed to be attacking the stems of *Desmodium cephalotes*. A disease of *Acacia decurrens*, which may be caused by an insect, has been reported. It has been described as "Fire Blight," but is quite distinct from the "Fire Blight" of Acacia

in Australia, which is due to the attacks of the beetle, *Paropsis orphana*, Erich. *A. decurrens* is stated to have been injured by the caterpillars of the moth *Euproctis scintillans*, Wlk., and by a species of *Tortrix* which is also said to have attacked tea in two Acacia-planted fields.

Crawford (D. L.). **A Good Ant Exterminator.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* iii, no. 10, October 1914, pp. 438–440.

The most effective and cheapest means of exterminating a colony of the Argentine ant [*Iridomyrmex humilis*] when it is in the ground or in a box of refuse, etc., is to pour into the nest a quantity of dilute creolin sheep-dip. Dilute the liquid about one part to twenty of water and shake or stir thoroughly ; it should make a milky or soapy liquid. Before using it, the soil round the nest should be thoroughly loosened with a crowbar and as much as possible removed. This process gives little trouble and the expense is small. One quart of creolin sheep-dip is enough to make five gallons, sufficient for a large colony, and the whole operation need not take over half an hour. If the nest be near a plant or a tree, dilute the creolin with thirty parts of water, in order not to injure the roots. An equally effective substitute for the commercial creolin sheep-dip may be made with 1 pint crude carbolic acid, 1 pound soap dissolved in hot water, and 2 pints of water. Shake and mix thoroughly these ingredients and then dilute with about 30 parts of water to one of the stock solution ; if applied very near to a plant, dilute with fifty parts of water. It is rather troublesome to mix these ingredients properly, and therefore it is usually more advantageous to purchase the sheep-dip if possible.

Cook (A. J.). **The Date Scales.**—*Mthly. Bull. Cal. State Commiss. Hortic. Sacramento,* iii, no. 10, October 1914, pp. 440–441, 2 figs.

Blanchard's scale, *Parlatoria blanchardi*, Targ., and the Marlatt scale, *Phoenicococcus marlatti*, Ckll., are the only obstacles to successful date culture in parts of California and Arizona. *P. blanchardi* attacks the exposed leaves and stems, and soon covers the plant entirely ; it may be controlled by fumigation, or severe pruning and firing with a torch soon extirpates the scale. *P. marlatti* attacks the sheath beneath the leaf stem, under a thick webbed matting of the palm fibres, often more than two inches beneath the surface, which affords great protection to the insects. According to B. J. Drummond this pest may be eradicated by carbolic emulsion and the use of pruning tools and the torch. Most energetic means should be employed to destroy these two pests at once, even if this involved the total destruction of affected plants., A drastic quarantine over all infested plants now in orchards or nurseries is necessary and an equally drastic inspection law must be enforced so that the scales shall not be further introduced, thus safeguarding what is destined to become a very important industry.

Insect Notes.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* iii, no. 10, October 1914, p. 445.

The maple louse, *Drepanaphis acerifolii*, Thomas, has been found abundantly on large-leaved maples, and the paper birch louse, *Calaphis betulaecolens*, Fitch, on paper birch foliage. The tobacco flea-beetle, *Epitrix parvula*, F., and the western striped flea-beetle, *Phyllotreta ramasa*, Crotch, are reported as attacking many cruciferous and solanaceous plants ; cabbages, turnips and cauliflowers, were attacked by the cabbage maggot, *Chortophila* (*Phorbia*) *brassicae*, in September 1914. The fruit-tree bark-beetle, *Scolytus* (*Eccoptogaster*) *rugulosus*, seriously damaged apricot and cherry trees, causing a copious flow of gum. Inspection of several orchards, fumigated for the control of *Coccus citricola*, Campbell, [see this *Review*, Ser. A, ii, p. 585], indicated satisfactory results. *Pseudococcus citri*, the citrus mealy bug, and the western twelve-spotted cucumber beetle, *Diabrotica soror*, Lec., have done considerable damage to citrus trees, and to garden crops. The Chrysomelid, *Disonycha 5-vittata*, Say, defoliated willow trees during September, and madaro potato vine and Shasta daisy blossoms have been damaged by the salt-marsh caterpillar, *Estigmene acraea*, Dru., which, however, is largely controlled by a Tachinid parasite. *Bruchus pruininus*, Horn, has been taken from locust and acacia seeds, and larvae of the grape leaf-roller, the Pyralid, *Desmia funeralis*, Hb., from leaves of Muscat grape vine. A carrion beetle, *Silpha ramosa*, Say, has been reported as doing considerable damage to garden truck. Asparagus and *Solanum jasminoides* have been infested with *Saissetia oleae*, Bern., from which *Coccophagus lecanii*, Fitch, has been reared.

These notes conclude with a description by B. B. Whitney of the West India peach scale, *Aulacaspis pentagona*, Targ., which is often found in nursery inspection under a fungus, *Thelephora* sp., which grows upon some of the shrubs imported into California from Japan and China.

Fernald (H. T.). **The Army Worm** (*Heliophila unipuncta*, **Haworth**).—*Massachusetts State Bd. Agric., Boston*, Circular no. 22, October 1914, 13 pp., 1 pl., 2 figs.

In Massachusetts, between the 20th July and the 10th August 1914, reports of the presence of *Cirphis* (*Heliophila*) *unipuncta* were received from 67 towns. Though in the Southern States there are thought to be as many as six generations a year, in New England there are probably two generations of this pest, and in some parts of Massachusetts only one. The army worm probably passes the winter, in Massachusetts, as a partly grown caterpillar and resumes feeding the following spring, the pupal stage, which is passed a few inches below the surface of the soil, lasting for two or three weeks. The moths fly at night, laying their eggs in rows of about twenty, in the sheaths of the leaves of various grasses and grains, or on stubble, straw-stacks, etc., several rows sometimes being placed on the same plant ; five or six hundred eggs may be laid by a single moth. The incubation period lasts from 7 to 10 days and the average caterpillar stage about a month. In 1914, the moths appeared in late August and early

September, and were very noticeable towards night, feeding on the honeydew on pear leaves, secreted by the Pear Psylla [*Psylla pyri*], which was very abundant.

It appears to be always the later generation which does the damage and the caterpillars of which march in armies. The army worm generally feeds in low meadows, near swamps, where the grass is rank, and its appearance in large armies seems to be due to the exhaustion of its food-supply. Though usually feeding only on grasses and grains, under the pressure of hunger it may attack many cultivated plants. When abundant in its swampy haunts, it may be controlled by spraying with Paris green, 3 pounds to 75 U.S. gallons (62 Impl.) of water, or arsenate of lead, at least 5 pounds to 50 U.S. gallons ($41\frac{1}{2}$ Impl.) of water. This treatment destroys the grass or crops the caterpillars may be feeding upon, but checks the spread of the invading army. Sometimes it is possible to place a thick strip of Tarvia (road oil) across the line of march, which should be continually renewed. A furrow across their track or a band of powdered agricultural lime an inch or more deep are quite effective barriers. Excellent results attended the use of a bran mash bait prepared by taking 1 lb. Paris green, 25 lb. bran or middlings, 2 quarts of cheap molasses, and water to make a thick mash when thoroughly stirred. The caterpillars fed freely on it when it was placed in strips across the line of march or spread broadcast, but birds feeding upon it or upon the poisoned caterpillars will also be poisoned.

Masher (F. H.) & Webber (R. T.). **The Relation of Variation in the Number of Larval Stages to Sex Development in the Gipsy Moth.**—*Jl. Econ. Entom., Concord,* vii, no. 5, October 1914, pp. 368–273.

Experiments on the food-plants of *Lymantria dispar*, L., have incidentally shown that there is a more or less constant difference in the stages in which the larvae spin up previous to pupating, and that those larvae which pupate in the 5th stage produce males, while those having a 6th stage develop females. A repetition of these feeding experiments in 1913 corroborated this, and of 56 fifth stage larvae, six were parasitised, four diseased, and the remaining 46 produced male pupae ; of 26 sixth stage larvae, three were parasitised, and the remaining 23 developed females. The development of a 7th stage was not observed. It is stated that *L. dispar* is evidently changing its habits in the United States ; 16 or 17 years ago, elm, barberry and many other trees and shrubs which are to-day rarely infested by the gipsy moth, were reported as common food-plants. *L. dispar* is itself less hardy and more susceptible to disease and there is a perceptible decrease in the average number of eggs laid except in newly infested localities.

Felt (E. P.). **Notes on Forest Insects.**—*Jl. Econ. Entom., Concord,* **vii, no. 5, October 1914, pp. 373–375.**

Malacosoma disstria, Hb., was exceptionally abundant in 1912 and 1913, and in 1914 it stripped oaks on Long Island and sugar maples in the Hudson and St. Lawrence valleys. Extensive areas of poplar were also defoliated, a marked preference being shown for the tops of

the taller trees; pin or bird cherry, cornus and elms were partly stripped when near the poplars, while red maple, birch, pine, balsam, spruce and hemlock were practically untouched. As in the first outbreak 15 years ago, there has been a superabundance of *M. americana*, F. *Melanophila fulvoguttata*, Harr., has destroyed hemlocks, *Agrilus bilineatus*, Weber, oaks, and *Scolytus* (*Eccoptogaster*) *quadrispinosus*, Say, thousands of hickories in the neighbourhood of New York. The outbreak of *S. quadrispinosus* began about 1908; since then, there has been a progressive decline in the rainfall, the deficiency generally coming in the growing months from July to October. It is suggested that this scarcity of water reduced the normal powers of resistance of the trees, and rendered them unusually susceptible to the attacks of *S. quadrispinosus*. The recent extensive plantings of white pines in New York has resulted in serious infestations by *Pissodes strobi*, Peck. The efficacy of hand collecting as a control measure against this species was tried on an area of 50 acres: large insect-nets were used, the trees being tapped to knock off the insects; at first from two to four weevils were caught per tree, at the last one or two insects per row of some 400 trees, the collections being made four times; the cost amounted to about 5s. per acre. Collecting should start in the first or second week in May at 10-day intervals and only three should be necessary; with improved devices, the cost could probably be materially lowered. Since the adults of *P. strobi* may live two or three years and oviposit each season, collecting is more useful than the destruction of infested shoots.

HASEMAN (L.). **Entomological Work in Missouri.**—*Jl. Econ. Entom., Concord*, vii, no. 5, October 1914, pp. 376–378.

An outline report of the entomological work done in Missouri since 1910 is given, together with a brief review of the work done prior to that date. Attention has mainly been given recently to orchard insects and provision has been made for educational work in this direction. Improvement in the conditions of bee-keeping are greatly needed.

WOLCOTT (G. N.). **Notes on the Life-History and Ecology of *Tiphia inornata*, Say.**—*Jl. Econ. Entom., Concord*, vii, no. 5, October 1914, pp. 382–389.

Tiphia inornata, Say, is the most important parasite of the genus *Lachnosterna* in the United States. From September 1912 to November 1913, the writer was collecting *T. inornata* cocoons to send to Porto Rico to help in the control of the *Lachnosterna* grubs, which are a serious pest to sugar-cane and other crops there. For this work, the study of the factors limiting the abundance of *T. inornata* was undertaken in Illinois. The life-history of *T. inornata* is described, and evidence given of the fact that *Tiphia*, under favourable circumstances, greatly reduces the numbers of *Lachnosterna* grubs over limited areas. The adult females of *Tiphia* are weak fliers and tend to remain in their original home; the rate of multiplication is rapid, two generations probably occurring in the summer. The males can fly long distances and are often collected feeding on the flowers of

golden rod and asters. Several important factors control the abundance of *T. inornata*, such as scarcity of large grubs in the years when the dominant species occur either as beetles or small grubs. The life-cycle of most species of *Lachnosterna* is completed in three years, and when full-grown grubs are abundant, plenty of hosts for *Tiphia* occur; but the next year only beetles, eggs and small grubs are present and *Tiphia* then either parasitises grubs of non-dominant species or perishes. A permanent scarcity of grubs is caused by unfavourable agricultural practices, or the absence of trees to furnish a food supply for the adults. Frequent ploughing, rotation of crops, and heavy grazing of meadows and fields by horses, cattle and especially pigs, destroy large numbers of *Lachnosterna* beetles. Practically all the fields from which the largest numbers of *Tiphia* cocoons were collected, were of two types, either with several trees of *Populus deltoides* in or near them, or near *Quercus* or mixed woods. *P. deltoides* and *Salix* are preferred to oaks and elms by most species of *Lachnosterna*, and *Maclura aurantiaca* and two species of maple are the only common trees unacceptable to any *Lachnosterna* beetles. As an adequate supply of *Lachnosterna* grubs is restricted to areas supporting the favoured trees, the dispersion of *Tiphia* is checked where they are absent. Unfavourable soil, which favours other parasites of *Lachnosterna*, is an important factor. *Tiphia* is abundant on the black clay and brown silt loam, but *Elis sexcincta*, F., another parasite of *Lachnosterna*, seems better adapted to the grey clay and sandy, gravelly loam of the hilly and wooded parts of Illinois. There are at least two parasites, a Bombyliid fly, *Exoprosopa fascipennis*, Say, and a Rhipiphorid beetle, *Rhipiphorus pectinatus*, which attack *Tiphia*, but these seldom infest more than 1 or 2 per cent. of the cocoons. Autumn ploughing causes premature emergence of the adults and exposure of the cocoons to predatory enemies.

MINGWORTH (J. F.). **Further Notes on the Breeding of the Tachinid Fly parasitic on the Cane Beetle Borer.**—*Jl. Econ. Entom.*, *Concord*, vii, no. 5, October 1914, pp. 390–398, 1 pl.

A thousand grubs of the borer *Rhabdocnemis obscurus*, Boisd., parasitised by the Tachinid, *Ceromasia sphenophori*, were transported from Hawaii to cane fields in Fiji. During the voyage, about 100 flies emerged from puparia which had been found in the borer cocoons, the emergence invariably taking place in the morning; all these were placed under inverted glasses and daily supplied with fresh slices of cane and bits of cotton batting saturated in water, care being taken to have no drops of water anywhere. On reaching Suva, Fiji, half the emerged flies were put in a cage stocked with canes containing *S. obscurus*, the other half were liberated in badly infested fields; about 50 flies were put into each of two cages in a drier section than Suva; the remainder of the parasites, then in the form of puparia, were placed in jars containing damp grass, in the fields, but sheltered and protected from ants; the next morning these were all found to have been destroyed by rats or mice. Mating observations showed that the flies begin to mate on the same day that they emerge and that a fly can produce upwards of 1,000 young, which are deposited as living maggots and are thus enabled to enter *S. obscurus* grubs at once,

escaping destruction by ants. A fresh quantity of cane containing borers was added to one of the cages when the flies were 16 days old, and the latter at once congregated about the new canes, indicating that the flies must have a continued supply of fresh grubs if they are to give the maximum number of young. Light and shade distribution in the breeding cages should be as nearly as possible like that under natural conditions; the flies invariably sought the morning sunlight, during which period mating generally takes place, and remained in the shade in the heat of the day. A few coconut leaves tacked on the outside of the cages gave satisfactory results, but there must be at least as great an area of light as there is of shade; a continual water supply should be maintained. After six weeks the parasitised canes were removed from the cages and placed in the field in upright boxes, raised from the ground by legs which were placed in tins of water and shaded with coconut leaves. Examination showed that 5,000 parasites were developed from 4,351 borer grubs; by adding artificially infested canes daily to the cages, it was possible to remove from 55 to 60 canes, containing fully 600 parasites, per week. *C. sphenophori* is subject to an unusually large number of predatory enemies and only a strong colony can withstand the losses they cause. The ant, *Pheidole megacephala*, is the deadliest enemy of the flies, attacking them at all stages, but carbon bisulphide was used effectively against them. Other enemies are spiders, especially a large jumping species, which hides in the leaf-sheaths of the cane, lizards, particularly one arboreal species, dragon flies, and insectivorous birds, especially a small flycatcher and the swallow. A bibliography is appended.

WOODS (W. C.). **A Note on *Rhagoletis pomonella* in Blueberries.**—*Jl. Econ. Entom., Concord,* vii, no. 5, October 1914, pp. 398–400.

Three species of the blueberry, *Vaccinium pennsylvanicum*, *V. canadense* and *V. vacillans* were attacked by *Rhagoletis pomonella*, Walsh, in the barrens of Washington during 1913. The specimens, like those reared from huckleberries in Connecticut, were below the normal size of the apple forms. The maggot appears to become full fed in one berry, which it leaves in order to pupate in the ground. The preliminary winnowing which is usually given to the berries to remove leaves, etc., also removes many infested ones, which are lighter than the others.

FINK (D. E.). **Injury to Truck Crops by Spring Tails** (*Sminthurus* sp.). —*Jl. Econ. Entom., Concord,* vii, no. 5, October 1914, pp. 400–401, 1 pl.

Recent injuries to Cucurbitaceous plants by *Sminthurus* in Virginia are recorded; seedling lettuce and cucumber were badly injured and in late autumn the petioles of spinach plants were destroyed. In May 1914, this pest, which had increased enormously since the previous year, was found attacking a potato field, feeding on the upper and lower surfaces of the leaves, as well as on the margins where *Leptinotarsa 10-lineata*, Say, had been feeding. The injury caused appears in the form of irregular holes in the leaves. The species

concerned is distinct from *S. hortensis*, but has not yet been identified. This pest has been observed on a great variety of garden crops and large numbers were found feeding on the egg-masses of *L. 10-lineata*, Say. Zinc arsenite, applied at the rate of 2 lb. to 50 gals. of water to seedling cucumbers, proved a successful control in the spring of 1913. Lead arsenate, 3 to 4 lb. in 50 gals. water, should also prove effective.

King (J. L.). **Contributions to the Life-History of the Lesser Peach Borer in Ohio.**—*Jl. Econ. Entom., Concord*, vii, no. 5, October 1914, pp. 401–403.

The results of observations on the life-history of *Aegeria* (*Synanthedon*) *pictipes*, G. and R., made in the lake district of N. Ohio, are given. The first moths from hibernating larvae appeared in May 1913, the numbers gradually increasing and reaching a maximum in mid-June, when they declined until early August. This was followed by another period of increase during August, at the same time that *Sanninoidea* reached its maximum in this district. Details are given of the larval development and the life-cycle, there being one full brood and a partial second one in the year.

Webster (F. M.). **An Unrecorded Parasite of *Toxoptera graminum*.**—*Jl. Econ. Entom., Concord*, vii, no. 5, October 1914, pp. 403–404.

Eupachylomma (*Wesmaelia*) *rileyi*, Ashm., is stated to have been described from specimens obtained by the author at Oxford, Ind., in July 1884, in cages containing growing wheat and to have been undoubtedly reared from *Toxoptera graminum*, but has not again appeared in any further experiments with that species.

Aldrich (J. M.). **A New *Leucopis* with Yellow Antennae.**—*Jl. Econ. Entom., Concord*, vii, no. 5, October 1914, pp. 404–405.

A new Aphid parasite, *Leucopis flavicornis*, sp. n., reared from a colony of *Pemphigus*, probably *P. fraxinifolii*, taken from *Fraxinus* leaves, 10th May 1910, is described.

Cockerell (T. D. A.). **The Cotton-worm Moth in Colorado.**—*Jl. Econ. Entom., Concord*, vii, no. 5, October 1914, p. 405.

Large numbers of moths are recorded as having appeared around the electric lights in Boulder, Colorado, on 21st September 1914, about 90 per cent. of which were *Chloridea obsoleta*, F., the remainder being *Alabama argillacea*, Hb., and one specimen of *Erinnyis ello*, L. These must have come at least 500 miles, and were doubtless migrating.

Tavares (J. S.). **Catalogo dos Aphideos Portugueses.** [Catalogue of Portuguese Aphids.]—*Broteria, Braga*, Ser. Zool., xii, pt. 3, October 1914, pp. 177–193, 8 figs.

In this list, 89 species are recorded with their food-plants and the localities in which they were taken. The new genus, *Tavaresiella*, Del Guercio, is figured and described at length.

Anutchin (A.). **Матеріалы къ біологіи новаго вредителя люцерны–люцерновой моли.** [Materials for the biology of a new pest of lucerne–"lucerne-moth"].—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, no. 10, October 1914, pp. 913–916.

A new Lepidopterous pest of lucerne, discovered in August 1914, in the lucerne fields of the experimental station in the Starvation Desert, where it has done great damage, is recorded. This moth has not yet been identified, but the females oviposit on the upper leaves, the larvae feeding in a web. Caterpillars of various stages were first discovered on 23rd August and the first imago was observed on 6th September. Two generations appear to have occurred between 23rd August and 13th October.

Plotnikov (V.). **Къ вопросу о борьбѣ съ азіатской саранчей въ Семирѣчьѣ.** [The question of the control of *Locusta migratoria* in the province of Semiretchensk (Turkestan).]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, no. 10, October 1914, pp. 900–912.

The author was deputed to investigate the problem of controlling locusts in the province of Semiretchensk, the authorities of which obtained a grant of about £50,000 for the purpose of totally destroying the breeding places. The history of the outbreaks of *Locusta migratoria* in that province, since 1869, is reviewed; in the autumn of 1913, more than 81,000 acres were infested, the figure not including the district of Lepsiask, which is usually the most affected. The breeding places of locusts in the province are situated round the shores of several lakes and on the banks of some of the rivers. All these areas are probably connected with those in the adjoining districts of the province of Syr-daria. Up to 1911, the campaign was conducted chiefly by means of driving into trenches, burning, etc., but since then spraying with Paris green has gradually been introduced. Owing to the large area involved, the presence of infested areas in the adjoining parts of China which cannot be controlled from Russia, and the difficulty of conducting the campaign in many outlying districts arising from the absence of roads, etc., control measures must chiefly protect the cultivated areas by concentrating the operations and limiting them to such places. Many infested areas are covered only with reeds, which, although serving as forage for the horses and cattle of the Kirghis, are so abundant that the damage done is not important, nor is the agriculture of the Kirghis there of much consequence. There is a possibility of damage being done to cultivated crops by migrating swarms coming from these districts, but the available information goes to show that the greatest devastation in a given locality is usually caused by locusts hatched locally. Should the campaign be conducted over all the breeding places, the advantages gained will not compensate for the enormous cost of such an undertaking. The organisation and conduct of the campaign is detailed, and spraying with Paris green is recommended in place of sodium arsenate or arsenite, as the latter would scorch the reeds, which are of some importance to the natives; where spraying is not possible, driving into trenches and burying, or burning the insects, is advised.

Other pests of agriculture in this province are briefly referred to, including *Cydia pomonella*, *Hoplocampa brevis*, *Hyponomeuta malinellus*, *Calliptamus* (*Caloptenus*) *italicus*, various Noctuids, *Rhinoctonus ampelinus*, *Oscinis frit*, and Elaterid larvae, which frequently play havoc with the crops. The appointment of a special Entomologist for this province is urged.

S. P. **Порча ,,жучкомъ'' пшеницы въ амбарахъ у туземцевъ.** [The damage to wheat in native stores by a beetle (*Calandra granaria*).]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, no. 10, October 1914, pp. 951–953.

Great damage is reported to stored wheat in Turkestan by *Calandra granaria*, and remedial measures are rarely taken by the natives or by the Russians against it. The construction of damp and ill-ventilated storehouses, which are not whitewashed even with lime, favours the multiplication of this weevil.

Pérez (C.). **Régime mycophage de** *Thea vigintiduopunctata*, **L., (Coccinellidae).** [The fungus diet of *Thea vigintiduopunctata*, L.] —*Bull. Soc. Entom. France, Paris*, no. 14, 22nd July 1914, pp. 415–416. [Pubd. 30th November 1914.]

Dense colonies of Aphids noticed at the top of oak plants in a garden were constantly visited by ants, but were left untouched by both adults and larvae of *Thea vigintiduopunctata*, L., observed lower down on the same plants. These Coccinellids were feeding on a growth of oak *Oidium* which thickly covered many of the leaves. This observation, which was continued over five consecutive days, confirms Weise's statement that this species feeds on fungus parasites of hops and on *Astragalus glycyphyllus* (Liquorice vetch).

Brèthes (J.). **Une nouvelle espèce d'Ulidinae [Dipt.] du Tucuman.** [A new species of Ulidinae (Dipt.) from Tucuman.]—*Bull. Soc. Entom. France, Paris*, no. 2, 1914, pp. 87–88, 1 fig.

A description of the Dipteron, *Euxesta chavannei*, sp. n., is given. M. Jean Chavanne, who collected the insect, states that it causes the decomposition of the young shoots of the sugar-cane and prepares the way for the disease known as "polvillo" caused by *Bacillus sacchari*, Speg. It is allied to *E. acuta*, Hend., and *E. argentina*, Brèthes.

Lyle (G. T.). **Contributions to our Knowledge of the British Braconidae. No. 2.—Macrocentridae, with description of Two New Species.**—*The Entomologist, London*, xlvii, nos. 617 and 618, October and November 1914, pp. 257–262, 287–290, 1 plate.

The following new species are described:—*Macrocentrus equalis*, sp. n., *Zele infumator*, sp. n., *Z. geminator*, nom. nov. (for *Z. chloropthalmus*). *M. nitidus*, Wesm., is recorded for the first time as British. Other species recorded are: *M. abdominalis*, F., bred from *Tortrix viridana*, L., and *M. marginator*, Nees, bred from larvae of various Aegeriidae (Sesiidae), and the cocoons of which have been found in burrows of the gooseberry clearwing, *Aegeria tipuliformis*, L., in Sussex and Dorset.

VASSILIEV (Eug. M.). **Новый вредитель высадковъ сахарной свекловицы изъ Кубанской области и другіе вредители.** [A new pest of transplanted sugar-beet from the province of Kuban (*Podonta nigrita* Fb.) and other pests.] *Report by the Entomologist of the Experimental Myco-Entomological Station of the All-Russian Society of Sugar-Refiners in Smiela, govt. of Kiev.* **«Вѣстникъ Сахарной Промышленности.»** [*Herald of the Sugar-Industry,*] *Kiev*, nos. 41 and 43: 25th October and 8th November 1914; pp. 366–370 and 425–429, 1 fig.

The author, in July last, visited the beet plantations of the province of Kuban, which cover an area of over 9,500 acres. The cultivation of sugar-beet had been first introduced into the province only two years previously. Wheat, maize and sunflower are the principal crops cultivated in this province. Many harmful insects occur, including various species of CARABIDAE, among which *Zabrus tenebrioides*, Goeze, and *Pardileus calceatus*, Duft., are specially mentioned. Elaterid larvae occur in great numbers, especially on plots which have been uncultivated for some time. Deep ploughing in autumn and other mechanical treatment of the soil is suggested as a means of decreasing the numbers of this pest. The larvae of species of *Melolontha* can only find a scanty food supply in the few orchards and on willows, and present a less serious problem than in localities with many forests and orchards. Against the caterpillars of *Phlyctaenodes sticticalis*, L., spraying with 2 per cent. barium chloride proved quite efficient, whereas in other parts of Russia a strength of 5–8 per cent. is usually required, even this strength being insufficient in some cases, as in one locality of the government of Charkov, where good results were obtained only with a solution of a strength of 10–12 per cent. These conflicting results may be due to differences in the temperature and the amount of moisture in the atmosphere at the time of the spraying. It is already recognised that the effect of barium chloride upon *Bothynoderes punctiventris*, Germ., is the greater, the higher the temperature and the clearer the sky; probably its effects on the caterpillars of *P. sticticalis* may depend on the same conditions. Pospielov [see this *Review*, Ser. A, ii, p. 177] has stated that in hot and dry weather the weak action of barium chloride is compensated for by the paralysing effect of the sun's rays on the beetles of *Bothynoderes punctiventris*, and has pointed out that the question of the paralysis produced by the sun's rays requires further investigation, as it cannot be limited only to the above beetles and is at variance with the fact that in hot weather most pests, including both those above mentioned, show an increased feeding rate and thus devour a greater amount of poison. The different effect obtained by various solutions of barium chloride may depend also upon the composition of the water used, as water containing sulphates and carbonates decreases the effect of this insecticide by transforming it into barium sulphate and carbonate, of which the former is not poisonous, and the effect of the latter is slower than that of barium chloride. The multiplication of this pest in the province is favoured by the abundance of weeds, on which it oviposits and the neglect of remedial measures. *Lixus ascanii*, L., was found in the egg stage on *Amaranthus retroflexus*, from which the larvae pass into the stalks of beetroots. These weeds should

be burnt. *Adelphocoris lineolatus*, Goeze, was found amongst the crops, ovipositing and sucking the buds and young leaves of the transplanted beet; the destruction of the stems after the removal of the seeds is recommended as a remedy. *Cassida nebulosa*, L., and its larvae occur in some numbers owing to the abundance of *Atriplex* on which they preferably feed and oviposit, and this weed should be destroyed; spraying with barium chloride is also advised. *Bothynoderes punctiventris*, Germ., is as yet found in small numbers, but may increase in the future if beetroots are repeatedly sown on the same spots. Transplanted beet should never follow beetroots, as the former affords the most favourable conditions for the development of these weevils, the soil between the beds being less subjected to cultivation. Spraying the transplanted beets with barium chloride and surrounding them with trap trenches is recommended; these latter may also be useful against caterpillars of various species of *Euxoa* and *Barathra*. The introduction of rotation of crops in the province is urgently required.

The beetle, *Podonta nigrita*, F., was observed to devour the blossoms, the bracts and the juicy heads of beet-roots and to gnaw the stalks. Another species of the same family, CISTELIDAE (ALLECULIDAE), *Cteniopus sulphureus*, L., is already known as a pest of sugar-beet; while the species of the genus *Onophlus* are known to injure cultivated cereals. The imago of *P. nigrita*, the biology of which is still unknown, is figured and described, but it is thought that the larvae may live in the soil, as do those of *Onophlus*, and as Reitter believes to be the case with the larvae of *Cteniopus*. *P. nigrita*, also known as *Cistela nigrita* (*oblonga*, Ol.), occurs in Hungary, Tyrol and Switzerland as a pest of wheat and this may be the case in the province of Kuban, the beetles passing over to beetroot plantations when the grains of wheat become too hard.

Another species, *P. flecki*, Reitt., is known in the Dobrudscha, while in South Russia and East Caucasia, *P. daghestanica*, Reitt., occurs, and in the Caucasus, *P. morio*, Kiesw., (known also in Greece) and *P. elongata*, Ménétr. Like *Anisoplia*, these beetles are usually active on the borders of the fields. Handpicking is the only known remedy at present.

Бюллетень о вредителяхъ сельскаго хозяйства и мѣрахъ борьбы съ ними. [Bulletin of the pests of Agriculture and methods of fighting them.] Published by the Entomological and Phytopathological Bureau of the Zemstvo of the govt. of Charkov. *Charkov*, no. 6, November 1914, 12 pp.

The following articles relating to Entomology appear in this number of the Bulletin.

VASSILIEV (Eug. M.). **О запасахъ хлористаго барія въ Россіи.** [On the stock of barium chloride in Russia], pp. 1–3.

Bari m chloride as an insecticide is used throughout the southern sugar-beet-growing area of Russia against *Bothynoderes punctiventris*, Germ. On the advice of Mokrzecki it is now also applied against *Phlyctaenodes sticticalis*, L., and various species of *Hyponomeuta*.

The whole of the amount required is imported from abroad, and the available stocks appear to be very small and can hardly cover the demand. It is suggested that the sugar-refineries should themselves manufacture the necessary quantity of barium chloride for their plantations from barium carbonate, though the necessary raw material, the mineral "Witherite," only occurs in payable quantities in England; it might be possible, though more troublesome, to prepare barium chloride from barium sulphate.

LEBEDEV (F. N.). **Объ опрыскивателяхъ и инсектисидахъ.** [On sprayers and insecticides], pp. 3–5.

Hitherto, Germany has been the chief and almost the only country supplying Russia with sprayers and insecticides, though the former were very often inferior machines, and one Russian factory at least could undertake to manufacture sprayers. The use of sodium arsenite instead of Paris green is advocated.

AVERIN (V. G.). **Къ вопросу объ опрыскивателяхъ и инсектисидахъ.** [The question of sprayers and insecticides], pp. 5–6.

A list of 13 Russian factories which could manufacture sprayers is given.

SERBINOV (I. L.). **Инструкція для собиранія грибныхъ, протозойныхъ и бактеріальныхъ заболѣваній насѣкомыхъ.** [Instructions for the collection of fungoid, protozoal, and bacterial diseases of insects], pp. 6–8.

The author describes the symptoms of the diseases of insects produced by fungi, protozoa, or bacteria and gives instructions for the preparation of examples thus attacked before they are sent to him to the Central Phytopathological Station of the Imperial Botanical Garden of Peter the Great in Petrograd.

The dead larvae, pupae, or imagines must first be dried at the room-temperature on a sheet of clean paper and then, together with their ejections, if any, be wrapped in separate sheets of paper and sent in wooden, not in metallic boxes, accompanied by the necessary data. It is also advisable to send some of the same material fixed in 10 per cent. formalin, or in 70 per cent. alcohol to which a few drops of iodine have been added. Living specimens, which are specially necessary in order to cultivate the microbes at the station, should be sent in a 10 per cent. salt solution.

Pear Leaf Blister Mite.—*Jl. Bd. Agric., London*, xxi, no. 8, November 1914, pp. 731–732.

The Board's Leaflet No. 239 on the pear leaf blister mite, *Eriophyes pyri*, has been revised and the following methods of dealing with this pest replace those previously given.

In mild cases, a single application of a winter wash may be sufficient, but otherwise two applications should be made as suggested below. (1). Lime-Sulphur Washes. A lime-sulphur wash at winter strength

may be applied after the leaves have fallen about November and again when the buds begin to swell about February. Owing to variations in strength in most home-made lime-sulphur, it is generally better to buy the concentrated wash from a reliable manufacturer who will provide the dilution instructions. At Wye, Theobald found that a lime-sulphur-caustic-soda wash applied in November and February was more effective than either lime-sulphur alone or paraffin emulsion. In addition to lime-sulphur, his formula contains 1 lb. of caustic soda and 1 lb. of soft soap to each 10 gallons of water. (2). Paraffin emulsion may also be used at the above periods. In Bulletin 283 of the New York Experiment Station five parts of water are recommended with one part of the standard emulsion : Paraffin 2 gals., water 1 gal., soft soap ½ lb. The soap should be dissolved in the boiling water and while still hot the paraffin should be added, the whole being thoroughly churned. In England, ten parts of water are usual for a winter wash. A dilute emulsion is stated to be of service when applied to the foliage in early summer and may be produced by diluting the standard emulsion with 25–30 parts of water. (3). Where an attack is noticed before the mites have spread, or where only a few small trees are affected, the blistered leaves may be collected and burnt.

LEFROY (H. M.). **A trap for Turnip-Fly.**—*Jl. R. Hortic. Soc., London*, xl, pt. 2, November 1914, pp. 269–271, 2 figs.

Turnip seedlings at Wisley have been heavily attacked by the blue flea-beetle, *Phyllotreta consobrina*, and also, but to a lesser degree, by the yellow-striped form, *P. undulata*. The seed was drilled in rows a foot apart, and the young plants became infested from a neighbouring plot of broccoli. It was observed that when the flea-beetles were disturbed, they leapt outward from the plants, alighting about midway between the rows. A trap providing a sticky layer for the beetles to alight on was therefore devised and was very successful. The trap consists of two boards set at a slope on a pair of runners, like those of a sledge or toboggan, with a space between them. The trap is drawn along the drill, so that the plants pass through the space in the middle. In order to disturb the beetles, a loop of string hangs from a cross-bar and brushes the plants, causing the flea-beetles to leap to the side and alight on the sticky boards. An illustration of the trap is given, together with the following constructional details : To a frame made of six pieces of half-inch deal 20 inches long, two pieces of thin board (20 inches by 5 inches) are fixed so as to slope outwards and upwards on the sides of the frame. These sloping boards are held apart by a cross-bar and an end-piece, so as to have four clear inches between them at the bottom. The two bottom outer pieces are made half an inch deeper than the inner ones, the whole trap running on the outer pair like a sledge on runners, the ends being rounded off to allow free running. The sloping boards, the end pieces facing them, and the cross piece between them are greased. From the cross-bar between the sloping pieces hangs a loop of stout string, and strings four feet long are attached to the front top corners. If made of deal, this apparatus is so light that a child can draw it along the rows, but it is better for two persons to use it and for them to walk a few feet away on each side, so that the beetles are not disturbed until the sticky boards reach them.

If two persons are not available, one can work the trap, drawing it with outstretched arm, and walking so that his shadow falls on rows already done. The cost of the trap is about 2s. or 2s. 6d. As an adhesive substance for the boards, vaseline was found to melt too readily under the hot sun, but Morlar Hop-wash (pure and undiluted), Wood and Sons' smearing grease, and black currant mite grease were found suitable. It is important to have a material that remains sticky and does not permit the beetles to jump off before they sink into it. The principle of this trap can probably be applied to field use by making a multiple one based on the width of one of the drills.

CUTHBERT (H. G.). **Wasp preying on Sawfly Caterpillars.**—*Irish Naturalist, Dublin*, xxiii, no. 11, November 1914, p. 238.

When clearing gooseberry bushes of the larvae of *Pteronus ribesii*, Scop., queen wasps were found preying on them. These were mainly those of *Vespa rufa*, var. *austriaca*, *V. norvegica*, and *V. germanica*: the queens were later supplemented by workers of *V. norvegica* and *V. rufa*.

BERTHOUMIEU (V.). **Trois nouveaux Ichneumoniens du Nord de la France.** [Three new Ichneumons from the North of France.] – *L'Echange, Revue Linnéenne, Moulins*, xxx, no. 359, November 1914, p. 75.

The following new species of Ichneumons are recorded: *Ichneumon productus* and *Platylabus ambiguus*, from the Ardennes; and *I. pigeoti*, from Rethel.

FRENCH (C. Junr.). **The Thrips Pest.** *Jl. Dept. Agric. Victoria, Melbourne*, xii, pt. 11, November 1914, p. 688.

Benzol emulsion is recommended against thrips, and also the following preparation of nicotine:—Steep 1 lb. tobacco in 1 gal. hot water, leave to soak for 24 hours; boil 1 lb. soap in 1 gal. water until the soap is dissolved; strain the tobacco water into the soap water, stir well and make up to 5 or 6 gals. Spraying with coal tar water or a weak kerosene emulsion is a good deterrent; for coal tar water, boil 1 lb. coal tar in 2 gals. water, and while hot, add from 50–100 gals. water.

PESCOTT (E. E.). **The Orchard.** *Jl. Dept. Agric. Victoria, Melbourne*, xii, pt. 11, November 1914, p. 701.

Advice as to spraying in the month of November is given: Strong tobacco solution for peach aphis [*Myzus*] and for pear slug [*Eriocampoides limacina*] should be used, but lead arsenate is the better spray for the latter insect, though it must not be used if the fruit is nearly ripe: hellebore is also recommended. Lead arsenate is the best remedy for codling moth [*Cydia pomonella*]. The first spraying should be given at the time of the falling of the petals, the second a fortnight later, the others at the growers' discretion: four, and perhaps only three, sprayings will generally be sufficient: if the spraying is thorough, no bandaging need be done. Nicotine solution or pine spray may be used to check woolly aphis [*Schizoneura lanigera*.]

SHTCHERBAKOV (Th.). **Кукуруза и Шведская муха.** [Maize and the Swedish fly.]—(From the materials of the Entomological Branch of the Shatilovsk Agricultural Experimental Station). **« Вѣстникъ Сельскаго Хозяйства.»** [*Herald of Agriculture*], *Moscow*, no. 43, 8th November 1914, pp. 10–12.

During the summer of 1914, damage by the Swedish fly (*Oscinis frit*) to maize crops was observed at the Shatilovsk Agricultural Experimental Station, and this is said to be the first record of maize being attacked by this pest. The damage was first noticed on the 30th June on a field of the Station where maize has been sown for many years in succession. During the last few years the nature of the injuries was typical of this pest. The growing point of the stalk is attacked by the larvae and withers in the same way as is the case with other cereals, when injured by this pest.

Owing to the fact that the attacked plants show a tillering far in excess of that usually observed for maize and that the pest does not completely destroy the plants, it is doubtful as to how far this insect is really harmful. It has not been possible at present to compute the effect upon the yield.

Reference is made to the statements of N. V. Kurdjumov [see this *Review*, Ser. A, i, pp. 497–498] and N. V. Andrejeva who regard the Swedish fly as a useful insect in the case of summer-sown wheat, in that the injuries it causes stimulate the formation of fruit. The many advantages offered by maize, as compared with other grain crops, for further researches and experiments on the effects of this pest, are pointed out.

UVAROV (B. P.). **Ближайшія перспективы въ техникѣ борьбы съ саранчевыми.** [The immediate prospects in the technique of the fight against locusts.]— **« Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd*, no. 43 (55), 8th November 1914, pp. 1376–1380.

The possible effects of the present international position on the chemical method of controlling locusts in Russia, which of late years has nearly replaced the mechanical one, is reviewed. The war has closed to Russia the source of supply of the insecticide most used in this connection, viz., Paris green. This insecticide is, however, by no means the best, and attempts made to supersede it by arsenical preparations are recorded, excellent results being obtained with sodium arsenite. This insecticide, besides having a more rapid effect and being better able to withstand the influence of rains, proved also less expensive. In the campaign of the Entomological Bureau of Stavropol in 1913, the cost of spraying with sodium arsenite was about 20 per cent. cheaper when horse-drawn sprayers were used, and 13 per cent. cheaper in case of hand-sprayers than the corresponding cost of spraying with Paris green. The easy handling of sodium arsenite results also in an increase of the area sprayed per diem, which was for sodium arsenite 32 acres with horse-sprayers and 2½ acres with hand-sprayers, compared with 25½ acres and 2 acres respectively for Paris green. The disadvantage of this insecticide consists in its liability to scorch the plants, but this can be avoided by careful handling and regulation of doses. Reeds are peculiarly liable to be scorched by

this agent, but they are, however, of little economic importance. The author refers also to the good qualities of "Locusticide," consisting of a ready-made preparation of sodium arsenite with molasses, manufactured by an English firm, the advantages of which would be greatly increased if supplied in a more concentrated form, thus diminishing its bulk and saving carriage. Poisoned baits have many advantages over spraying, being considerably less expensive, as they do not involve the sacrifice of part of the crops in order to poison the insects and are in no way dependant on the weather. The Bureau at Stavropol prepared baits sufficient for about 1 acre consisting of 50 lb. of bran, 1 lb. of sodium arsenite and about 11 gallons of water at a cost of 6d. or 7d. per acre. There is no necessity to add molasses to the baits, but even when added, the price will compare favourably with the cost of spraying. "Locusticide" has been used by the Bureau as poison for the baits with great success. It was never found necessary to repeat the scattering of the poisoned baits, which attracted the locusts sitting on plants as well as those which were on the move; the first dead locusts were found a few hours after the baits had been put out and in not more than two days the whole swarm was destroyed. It is therefore concluded that the stoppage of the supply of Paris green need not put an end to the application of the chemical method and may even have beneficial results in bringing about the application of more effective insecticides and to increased use of poisoned baits.

Отвѣты. [Replies: *Pteronus ribesii*.]—«**Прогрессивное Садоводство и Огородничество.**» [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, no. 43, 8th November 1914, pp. 1330–1331.

Pteronus ribesii [*Nematus ventricosus*] attacks gooseberries and currants, its larvae appearing twice yearly in May and July and the pupae wintering almost on the surface of the earth. The remedies against it consist in spraying with Paris green, cultivating the soil in autumn in order to expose the wintering pupae to the influence of the weather, and shaking down the larvae on to cloth or paper and then destroying them. The last remedy is considered the most effective and is best carried out by throwing handfuls of basic slag on to the bushes, causing the larvae to drop down on the cloth or paper placed below. This can only be successfully done when the bushes are quite dry; after the operation they must be sprayed with water.

Les ennemis de l'olivier. [Pests of the olive.]—*Bull. bi-mens. Off. Gouv. Gén. Algérie, Paris*, xx, no. 18, 1st–15th November 1914, p. 286.

Two small beetle pests of the olive, the SCOLYTIDAE, *Phloeotribus scarabaeoides* and *Hylesinus oleiperda*, have been studied in Italy, where serious damage is done by them, both in the larval and adult stages. The first sign of attack is furnished by the twigs strewn on the ground beneath the tree, having been completely cut through. The older twigs which remain on the tree are attacked at the base, a deep excavation with rust-red edges being noticeable there. As the tree becomes weaker, the infestation increases in severity and the olive crop suffers severely. The adults hibernate in the chambers

they have excavated at the knot or at the base of a twig. Mating takes place in spring and about 50 eggs are laid in a gallery. A fortnight later the larvae hatch and excavate galleries, perpendicular to that of the parent. The larval stage lasts for from five to six weeks, and the pupal about 15 days. *P. scarabaeoides* has two generations, in June and in August, whilst *H. oleiperda* only has one. The former attacks the forks of young branches and the latter the older portions, and larger branches. Control methods consist in burning infested twigs, in correctly pruning the trees, and in properly cultivating the soil.

JAGER (F.) & HOWARD (C. W.). **The artificial fertilization of queen bees.**—*Science, New York*, N.S., xl, no. 1037, 13th November 1914, p. 720.

This paper records the apparent success of the artificial fertilisation of a queen bee. The operation was performed on 28th July; by 4th August the ovaries showed considerable development, as indicated by the size of the abdomen; on 18th August eggs began to be deposited and at least 3,000 were subsequently laid. These all produced worker-bees except four, which produced drones. In every respect, the brood, the capping of the cells, and the resulting worker-bees are perfectly normal. Studies of this queen are to be continued next season.

WARREN (W. H.). **Fruits under Glass.**—*Gardeners' Chron., London*, lvi, no. 1455, 14th November 1914, p. 322.

Cherry trees under glass should be washed with the following insecticide, to destroy the eggs of red spider [*Tetranychus telarius*]:— 1 lb. soft soap, 2 lb. flowers of sulphur, 2 ozs. common shag tobacco, added to 4 gals. water; every part of the tree should be washed well, the mixture being worked into the bark and between the buds with a painter's brush.

BONDARTZEV (A.). **Отвѣты.** [Replies: *Aspidiotus ostreaeformis*.]— **«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, no. 44, 15th November 1914, p. 1362.

Against *Aspidiotus ostreaeformis*, cleaning infested branches with brushes and spraying early in spring with a 3 per cent. solution of iron sulphate or with calcium bisulphide, obtained by boiling milk of lime with flowers of sulphur, are recommended as the best remedies.

RITOV (M.). **Червь въ корняхъ и кочерыжкѣ капусты.** [Worm in the roots and stalk of cabbage.]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, no. 45, 21st November 1914, p. 1402.

The females of *Chortophila* (*Anthomyia*) *brassicae*, Bouché, oviposit in May and June on stems of cabbage, the larvae damaging the plants by devouring first the outer soft strata of the stalk and later, mining it

and feeding on the soft pith; in the autumn, the larvae pass into the roots, where they pupate and winter. Remedies recommended include removing and burning the damaged plants and the rubbish, powdering coal-dust on the plants in May, which drives the larvae from them, watering the soil with a weak solution of potassium permanganate, and in autumn, with carbol-emulsion in order to destroy the larvae in the roots. Rotation of crops is also indicated.

EDWARDES (F. A.). **Gas Tar as a Remedy for Mealy Bug on Vines.** — *Gardeners' Chron., London*, lvi, 1457, 28th November 1914, p. 357.

The author recommends the use of gas tar as an efficient remedy for mealy bug [*Pseudococcus citri*] [see this *Review*, Ser. A, ii, p. 101].

KITCHUNOV (N. I.). **Культура цвѣтной капусты въ Петроградѣ.** [The cultivation of cauliflowers in Petrograd.] — **«Садъ и Огородъ.»** [*Orchard and Market-Garden*], *Moscow*, no. 11, November 1914, pp. 409–413.

Chortophila brassicae attacks cauliflowers even to a greater extent than it does ordinary cabbages. In many cases in Petrograd, the cultivation of cauliflowers has been made impossible by these larvae, which usually appear in the second year, especially when the soil has been manured with rotten dung.

Уничтоженіе медвѣдокъ. [The destruction of *Gryllotalpa*.] — **«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, no. 11, November 1914, p. 1029.

This note, republished from "The Bulletins of the Simferopol Branch of the Imperial Russian Society of Horticulture," refers to a control measure against *Gryllotalpa* recommended by a Swiss horticulturist. The remedy consists in placing calcium carbide in the burrows of this pest, and when the earth has then been trodden down, the carbide, under the influence of moisture, produces acetylene gas, which destroys the insects.

BALABANOV (M.). **О борьбѣ съ насѣкомыми въ садахъ.** [On the control of insects in orchards.] **«Садоводъ.»** [*The Fruit-Grower*], *Rostov-on-Don*, no. 11, November 1914, pp. 815–816.

The importance of a knowledge of the identity of various pests of fruit trees to owners of orchards, is emphasised.

In order to ascertain whether trees are infested with species of *Psylla*, cut branches should be examined with a lens for the presence of the minute eggs of this pest, which resemble linseed. Against these insects, spraying with tobacco extract ($\frac{1}{2}$ lb. to 30 lb. of water) and fumigation with tobacco dust are recommended.

L'entrée des végétaux en Algérie. [The importation of plants into Algeria.] — *Rev. Hortic. de l'Algérie, Algiers*, xviii, no. 1, January 1914, p. 35. [Received 4th February 1915.]

The measures relating to the importation of plants into Algeria [see this *Review*, Ser. A, ii, p. 591] having been objected to, it is pointed

out by the French Minister of the Interior that the importation of living plants from France has been responsible for the introduction of numerous insect pests, and some of these are already threatening the orange-growing industry, which is now increasing in the colony. All shipments of apple trees have been found to be infested with *Schizoneura* and apple-growing is rapidly being restricted in Algeria in consequence.

TRABUT (Dr.). **La défense des orangeries.** [The protection of orange groves.]—*Rev. Hortic. de l'Algérie, Algiers,* xviii, no. 3, March 1914, pp. 102–104. [Received 4th February 1915.]

Algeria has been protected against Coccid infestation by the strict anti-phylloxera legislation, but since the importation of living plants has been permitted [see above] new Coccids have been introduced (the reds cale, *Chrysomphalus aurantii,* being the most dangerous), chiefly on account of the resistance offered by the public to measures of control. Co-operative control has been found the only really efficient system, not only because the measures are general, but because such insecticides as cyanide of potassium, which would be a source of danger in the hands of individuals, can be used.

Le Pou Rouge en Espagne. [The Red Scale in Spain.]—*Rev. Hortic. de l'Algérie, Algiers,* xviii, no. 3, March 1914, p. 104. [Received 4th February 1915.]

Orange plantations, consisting of trees in full bearing, used to be valued at £400 per acre in the province of Valencia, but in consequence of infestation by red scale, *Chrysomphalus aurantii,* they are now only half as valuable.

MOLZ (E.) & SCHRODER (D.). **[The Life Cycle of *Sitona lineata* in Germany.]**—*Zeitschrift f. wissensch. Insektenbiologie, Berlin,* x, nos. 8–9, 1914, pp. 273–275.

The pea weevil, *Sitones* (*Sitona*) *lineatus,* L., which is recorded as particularly injurious in England, should also be classed among the dangerous insects in Germany. During 1913, the Experimental Station for Plant Diseases at Halle, received notification of 14 occurrences of this insect which caused damage by devouring the edges of leaves of leguminous crops ; seven outbreaks were on peas, two on beans, two on lucerne, and one each on haricot beans, vetches, clover and chicory. The writers have observed the larvae towards the end of April and the adults towards the end of May. In the open, the adults appear in April and May, as well as in July and August, and it therefore appears that the beetle is double-brooded in Germany, as in England. In order to reduce the damage in the larval stage, which occurs on chicory and beets in April, it is advisable to sow later in districts liable to attack. Since the larvae begin to pupate at the end of April and beginning of May, the larval stage will be almost completed before the plants appear. It is also desirable to sow more thickly in the infested areas.

Состоянiе хлѣбовъ и травъ въ Азiатской Россiи. [The state of grain and grass crops in Asiatic Russia.]—**«Сибирское Сельское Хозяйство.»** [*Agriculture of Siberia*], *Tomsk*, no. 12, July 1914, pp. 360–361. [Received 20th January 1915.]

This is a report on the state of grain and grass crops in different governments of Asiatic Russia in June 1914. In one district of the province of Turgai, outbreaks of a locust, of *Anisoplia austriaca* and certain caterpillars largely destroyed the crops. In the government of Orenburg, locusts have done great damage in many districts, having frequently destroyed the seedlings as early as May; they have specially injured wheat, but oats only slightly, and did not touch millet; they were also injurious to grasses in the steppes. Locusts have also appeared in the government of Tobolsk and in the provinces of Akmolinsk and Semipalatinsk.

«Вѣстникъ Русской Прикладной Энтомологiи.»—[*Messenger of Russian Applied Entomology*], *Kiev*, i, no. 1, 1914, 38 pp.

This is a new Journal published by the Kiev Society of Agriculture, the editors being L. I. Zdroevsky, V. N. Dobrovliansky (Director of the Entomological branch of the Kiev Station), E. V. Zvyerezomb-Zybovsky, V. N. Lutchnik, N. L. Pochodnia and E. V. Charleman.

In a preface, the editors say:—

"During recent years a great development of Applied Entomology has been observed in Russia. New Stations, Bureaux and other organisations for the study and control of insect pests are established yearly. The number of papers dealing with questions appertaining to Applied Entomology has consequently increased immensely and is still growing; it becomes therefore yearly more difficult to make use of the varied information scattered through numerous publications, many of which are not readily accessible."

The chief object of the Journal will be to record current entomological literature, and to publish abstracts of all works issued in Russia since January 1914. It is intended to make the bibliography as full as possible by giving short notes of the replies of the Editors of Journals to correspondents. The abstracts published are very varied in their character, but the Editors hope that, in time, a type of abstract will be arrived at which will best meet the wishes of readers. It is also intended to publish information on the current work of entomological organisations and of individual Entomologists.

No reviews of foreign literature will be published in the *Messenger*, as these are said to be fully dealt with by the *Review of Applied Entomology*.

The first number, after giving a short report on and the resolutions of the Entomological Conference at Charkov, contains abstracts of 65 publications and articles. There are also short notes on the composition of the Entomological Bureaux at Cherson, Kishinev, Warsaw, Charkov (Zemstvo), Voronezh, Simferopol, Smiela, Salgir, and Tula.

VITKOVSKY (N.). **Стрекозы враги пчелъ.** [Dragonflies as enemies of bees.] Reprint from **«Пчела.»** [*The Bee.*] *Ekaterinoslav*, 1914, no. 10, 4 pp.

Two cases, in which dragonflies were reported to attack and destroy hive-bees are recorded. In one case, such attacks were observed in

May in the district of Ekaterinoslav, where these insects have destroyed nearly half the bees, the species concerned being probably *Aeschna cyanea*, Müll. A second instance was reported by Novikov, who has observed them destroying bees in the government of Minsk. Migrations of these insects occur frequently in a southerly direction, and large flights took place in 1914 from the Baltic Sea and Finland southwards as far as the Black Sea. It is thought that the absence of food in the course of these migrations may have compelled these insects to attack bees.

Испытаніе квассина А. В. Зейделя. [Test of the quassine of A. V. Zeidel.]—**« Отчетъ о дѣятельности Кіевскаго Общества Сельскаго Хозяйства и Сельскохозяйственной Промышленности 1913 г.** [*Report on the work of the Kiev Society of Agriculture and Agricultural Industries for 1913*], *Kiev*, 1914, p. 106.

The importation of quassine from abroad being prohibited in Russia, it has been prepared by A. V. Zeidel, and the tests conducted by a special committee of the Kiev Society showed that this preparation is one of the most effective remedies against *Hyponomeuta malinellus* and aphids. The composition of this substance is not given, but the proportion used for spraying during the tests was 2 lb. of potash soap and 2 tubes of quassine (their size being constant) in about 108 gallons of water; the sprayings were carried out on firs against aphids and on apple trees against aphids and *H. malinellus*.

Kartzov (A. S.). **Культура лука рѣпчатаго, порея и чеснока.** [The cultivation of onions, leeks and garlic.]—**« Огородная библіотека.** [*Market-Garden-Library*,] Supplement to *Progressive Fruit-Growing and Market-Gardening*, *Petrograd*, 1914, no. 6, 31 pp., 9 figs.

In this book, the insect pests of onions are dealt with, amongst which the most important is *Hylemyia* (*Anthomyia*) *antiqua*, Mg., which, so far as is known, only attacks onions. The life-history of this pest is very similar to that of *Chortophila* (*Anthomyia*) *brassicae*, Bouché, and there is also a great resemblance between the larvae of the two species, which cause similar injuries and probably have the same natural enemies. The presence of *A. antiqua* on onions causes a general withering of the plants and usually occurs in spring, though there are several generations during the year, the insect wintering as an imago. Late sowing of onions is recommended in order to protect the seedlings from attack. Should the first sowing be attacked, the injured plants should be removed and the larvae on the roots destroyed.

In the government of Kiev, onions are also attacked by *Pieris brassicae*, L., *Plutella maculipennis* (*xylostella*), and *Phytometra* (*Plusia*) *gamma*, L., and less frequently by larvae of *Volucella bombylans*, L. (*mystacea*). These plants are also subject to attacks from the larvae of *Melolontha* and *Gryllotalpa*. Leeks suffer chiefly from *Acrolepia betulella*, Curt.,* the larvae of which mine the stems; powdering with soot and spraying with a solution of about 10 lb. of black soap in 27 gallons of water are recommended. Garlic is attacked by most of the pests which attack onions.

* [The insect in question is probably *A. ancetella*, Z., (= *betulella*, H.-S. nec. Curt.), the true *A. betulella* being purely British.—Ed.]

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SERIES A: AGRICULTURAL.

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« Бюллетень о вредителяхъ Сельскаго Хозяйства и о мѣрахъ борьбы съ ними. [*Bulletin on the Pests of Agriculture and Methods of controlling them*]. Published by the Entomological and Phytopathological Bureau of the Zemstvo of Charkov, *Charkov*, ii, no. 4, May–June 1914, 32 pp. [Received 22nd January 1915.]

The following articles relating to Entomology appear in this issue of the Bulletin :—

AVERIN (V. G.) & GALKOV (V. P.). **Мелкія Извѣстія.** [Short notes.] pp. 30–31.

Between the 28th and 30th May a great flight of *Libellula 4-maculata* was observed throughout the government, passing from south-west to north-east. There was also a great outbreak of *Bibio marci*, L., which, although recorded by some authorities as a pest, has not been observed to do damage. The Chrysomelid beetle, *Gastroidea viridula*, Deg., has greatly injured leaves of sorrel near Zmijev. Roses have suffered from many pests, their leaves being attacked by larvae of *Emphytus rufocinctus* (?), their buds by larvae of *Aradis plana* (?) and their stems and shoots by *Aulacaspis* (*Diaspis*) *rosae*. Several instances of caterpillars of *Gastropacha quercifolia* on plums and cherries were reported. *Chermes strobilobius* (?) was found on larches in Charkov, where spraying with quassia and green soap was very effective against it. The larvae of *Lithocolletis populifoliella*, Fr., a large outbreak of which had occurred on poplar trees the previous year, were again observed in Charkov, but in smaller numbers. Larvae of *Rhynchaenus* (*Orchestes*) *quercus*, L. injured the leaves of oaks in one locality and by the middle of June many trees had quite an autumn appearance.

AVERIN (V. G.), GALKOV (V. P.) & MALIK (E. E.). **Свѣдѣнія о появленіи и дѣятельности вредныхъ насѣкомыхъ за май и апрѣль.** [Information on the appearance and activity of insect-pests during April and May.] pp. 15–24.

Phlyctaenodes (*Eurycreon*) *sticticalis*, L., was at its maximum on 28th May, but the numbers of this species were, however, negligible in comparison with the previous year. In some localities of the district of Voltchansk, the caterpillars have injured beet. *Aporia crataegi* appeared in small numbers owing to the activity in the previous year of parasites and fungus diseases which destroyed some 45 per cent. of the caterpillars and pupae. This year the percentage of infestation with parasites is even greater, the most numerous being *Pimpla instigator* and some Tachinids. Against *Hyponomeuta malinellus*, Zell., good results were obtained by spraying with $1\frac{1}{2}$ per cent. of barium chloride, which, when applied at the proper time, gave a death-rate of 100 per cent. *Polydrosus sericeus* injured leaves of young seedlings in one orchard ; handpicking and shaking down from the trees was the remedy used. In two districts of the government apple trees have suffered greatly from *Rhynchites pauxillus*, which in conjunction with a fungus, *Polysticta briardi* (?), was responsible for the dropping of the leaves ; the different varieties were not equally affected, that known as " Borovinka " suffering most. *Anthonomus pomorum* has damaged some orchards in the district of Valkov, though

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in smaller numbers than in the previous year. A table is given, showing that the method of bringing down these weevils by means of a stream of water is less effective than by striking the trunks. *Sciaphobus squalidus*, Gyll., was noticed in the second half of April on cherry and pear trees in large numbers. A great number of the injured buds perished and the trees generally yielded less fruit. Shaking down is the best remedy and sticky belts must be put on the trees in addition. *Byturus tomentosus*, F., was observed at the end of May on raspberries in the district of Valkov. The beetles enter the buds through a hole in the side and destroy the pistils and stamens. They also injure blackberries, apples, pears, plums, and cherries. They oviposit on the blossoms up to the first half of July, and pupation takes place during August and September in the soil, not more than from 7 to 10 inches away from the host plant at a depth of 2 to $3\frac{1}{2}$ inches ; in a week the pupae produce beetles, which winter in the soil. The beetles should be shaken down from the bushes, which can be easily done by hand, preferably in dull, cold weather. Spraying with barium chloride, Paris green, djipsin, etc. may be useful during the blossoming season; earlier sprayings would appear to be useless, as the larvae are then inside the buds, and protected from the insecticide. The baskets in which raspberries are collected must be lined with paper or cloth, so as to prevent the escape of the larvae into the earth. The soil near the canes must be broken up in autumn and in early spring and watered with a solution of 3 per cent. carbolineum which will kill both larvae and adults. Carbon bisulphide may be injected into the soil in quantities of 5 c.c. to a depth of $3\frac{1}{2}$ inches ; the injector must be directed away from the bushes and the injections made in 5 or 6 spots at a distance of from 5 to 6 inches from the bush. Besides *B. tomentosus*, raspberries in the district of Valkov are also subject to the attacks of a small beetle of the family CHRYSOMELIDAE, *Batophila rubi*, Payk., which destroys the parenchyma of the leaves. *Sitones lineatus* was reported from one locality of the district of Charkov to be injuring vetches, and has also damaged lentils and peas. As remedies, spraying with $1\frac{1}{2}$ per cent. solution of barium chloride and with Paris green (3 lb. of green, 6 lb. of lime in about 100 gallons of water) are recommended. An adult beetle of *Opatrum sabulosum*, L., was observed gnawing the foliage of peas, though only the larvae of these insects have hitherto been recorded as pests. On the peas and vetches damaged by *S. lineatus*, small numbers of *Apion pomonae*, F., were also taken. *Lophyrus pini*, L., has done considerable damage to young pine seedlings in some districts. Shaking the larvae into pails, crushing them on the branches by hand with leather gloves, and spraying with barium chloride and Paris green, are the remedies suggested. *Eriophyes* (*Phytoptus*) *pyri* is found nearly everywhere causing injury to the leaves of pear trees.

TULLGREN (A.). **Två Blomvivlar.** [Two blossom weevils.]—*Medd. No. 93 Från Centralanst. för Försöksväsendet på Jordbruksomradet, Entom. avdeln., no. 18, Uppsala,* 1914, 12 pp. 1 col. pl.

This is a popular treatise on the biology of, and the remedial measures against these two weevils, which are common in Sweden, where 12 species of the genus *Anthonomus* have been recorded in all. The

period of pupation of *A. pomorum*, L., may be as short as a week instead of the usual 14 days, and the author confirms the opinion of Reh, that isolated trees are more exposed to attack than others. The following measures are recommended against *A. pomorum*:—Cleaning the trunks of the trees from moss and lichens; placing girdles of corrugated paper round them in order to provide hibernating quarters for the beetles, where they can easily be found and killed; and jarring the trees in the spring as soon as the beetles begin to appear, when they drop to the ground and can easily be collected. *Anthonomus rubi*, Herbst, has been more often recorded from strawberries than from raspberries.

SCHOYEN (T. H.). **Beretning over skadeinsekter och plantesygdomer i land og havebruket 1913.** [Report on the noxious insects and plant diseases of the field and the orchard in 1913], *Kristiania*, **1914, pp. 31–58, 17 text figs.**

Amongst insects injurious to cereals, *Aphis avenae* did damage in the western part of Norway during the unusually dry weather in July and August. *Chlorops taeniopa* was observed in several localities in Hardanger. As early sowing as possible of the spring crop and as late as possible of the winter crop is advised in order to compel the flies to lay their eggs on wild grasses. *Clidogastra* (*Cleigastra*) *flavipes* is injurious to timothy grass and it is advisable to plough deeply in autumn in order to bury the puparia or to omit this grass from the rotation for one or two years. *Hepialus lupulinus*, at Florö, cut the stems of the grass above the root to such an extent that the ground was literally covered by the stems. Against *Phyllopertha horticola*, ploughing and harrowing in order to expose the larvae to insectivorous birds and dressing in the autumn with gas lime, kainit or saltpetre are recommended. *Apion apricans* attacked the seed clover at the Agricultural School of Smaalenene so that nearly every flower contained the larvae. The clover had to be cut and either used as food or stacked green so that the larvae were killed. Against *Sitones lineatus*, which attacked clover in the spring, spraying with Paris green is recommended. The larvae of *Chortophila* (*Anthomyia*) *brassicae*, *Tipula oleracea*, *Meligethes aeneus* and *Plutella maculipennis* (*cruciferarum*) have been recorded as attacking cabbages. *Psila rosae* has damaged carrots, and the larva of an unidentified species of *Anthomyia* mined the leaves of sugar-beet. *Blaniulus guttulatus* has damaged lettuce in Christiania; watering the plants with lime-water is recommended. *Psylla mali* and several Rhynchota, such as the Capsids, *Orthotylus marginalis*, *Plesiocoris rugicollis* and *Psallus ambiguus*, have destroyed the young shoots of fruit trees, especially in the neighbourhood of Hardanger and Sogne, and have lately spread to the eastern part of the country. The need of co-operation and of organised spraying with nicotine soap solution against these insects is urged. *Psylla pyrisuga* has been recorded from several localities, but only from apple trees. Aphids and *Lepidosaphes ulmi* (*Mytilaspis pomorum*) have been repeatedly observed. In Aalesund, *Cantharis obscura* attacked apple blossoms, and in Lier and Drammen, *Anthonomus pomorum* has done damage. *Xyleborus* (*Tomicus*) *dispar* has been recorded from Fredriksstad, Röken and Porsgrund.

In Hardanger and Sogne, *Galerucella lineola* invaded the orchards in thousands and attacked the leaves of apple and pear trees. As these beetles during recent years had devastated the alders in these places, it was doubtful whether they would on this occasion oviposit on the fruit trees; fortunately, this did not happen. The beetles appeared in the orchards because the alders came into leaf later than usual and as soon as they were green, the beetles deserted the orchards. *Cheimatobia brumata*, *Cydia pomonella* and *Argyresthia conjugella* occurred in several localities, while *A. ephippiella* completely destroyed the buds of the cherry trees in an orchard in Egeberg for several years in succession. *Hyponomeuta variabilis* has been unusually common over a great part of the eastern country; burning the webs is recommended. The damage done by *Contarinia* (*Diplosis*) *pyricora* is increasing every year and in many places all the pears have been destroyed by it. Picking and destroying the fruits before the leaves have fallen, and digging and packing of the ground under the trees and mixing it with kainit are recommended. *Tetranychus telarius* or *T. pilosus* has been reported from plum trees and *Eriophyes pyri* both on apple and pear trees. Chinch bugs (*Blissus*) have in many localities damaged the leaves of currants, and *Rhopalosiphum ribis* and *Eulecanium* (*Lecanium*) *ribis* have been recorded from several places. Gooseberries have been damaged by the sawfly, *Pteronus* (*Nematus*) *ribesii*, and the moths, *Zophodia convolutella*, *Incurvaria capitella* and *Cheimatobia brumata*. The mite, *Tarsonemus fragariae*, which was recorded for the first time in 1912, is now widely distributed.

Областное Энтомологическое Совѣщаніе при Харьковской Губернской Земской Управѣ 20–21 сентября 1914 года. Доклады и журналы совѣщаній. [(Provincial) Entomological Conference at the Zemstvo of Charkov on 20–21 September (2–3 October) 1914. Papers read and minutes of proceedings.]—Published by the Zemstvo of Charkov. *Charkov*, 1914, 89 pp., 9 tables.

The proceedings of and recommendations passed at this Conference have already been dealt with [see this *Review*, Ser. A, iii, pp. 67, 68]. Some of the more important papers read on this occasion are now noticed.

SCHREINER (J. Th.). **О нѣкоторыхъ новыхъ инсектисидахъ, могущихъ замѣнить у насъ швейнфуртскую зелень.** [On some new insecticides, which can replace Schweinfurt Green for us.] pp. 48–50.

Several insecticides, which can more or less successfully replace Paris green, the chief supply of which comes from Germany, are suggested. Pure white arsenic has been largely used in many localities of the government of Saratov and along the Volga for the last forty years, but owing to the great damage it causes by scorching it is not recommended, although favourable results as regards insect pests have been frequently obtained.

Arsenite of lime, being a combination of arsenic and quick lime, is thoroughly recommended by many horticulturists and this preparation deserves serious consideration in orchards, though its application

against pests of field crops, especially against locusts, is laborious and inconvenient. Sodium arsenite is considered to be the most convenient and effective remedy against various locusts such as *Locusta migratoria*, *Calliptamus italicus*, *Dociostaurus maroccanus* and *Gomphocerus sibiricus*, which perish from this insecticide in from 15 to 20 hours after spraying, *i.e.*, quicker than when Paris green and lime is used.

It has not yet been tried in orchards, but is expected to prove successful. Djipsin is very effective against orchard pests, but less so against locusts and pests of field crops. Barium chloride is successfully used against *Hyponomeuta malinellus* and *Bothynoderes* (*Cleonus*) *punctiventris*.

During the discussion on this paper, it was pointed out by K. K. Miller and G. S. Sudeikin that good results were obtained at Kishinev and Voronezh with London purple. In the former place, it was used in a liquid form and no scorching was observed even with a strong concentration ; in the latter, it was applied in the form of powder (1 lb. of purple mixed with 10 lb. of flour) and gave good results against caterpillars of *Pieris rapae*, *Plutella maculipennis* (*cruciferarum*), and *Barathra* (*Mamestra*) *brassicae*, while a solution proved less effective.

Schreiner (J. Th.). **Результаты примѣненія новаго инсектисида, хромово-кислаго свинца.** [The results of the application of a new insecticide, acid chromate of lead.] pp. 50–52.

Experiments with acid chromate of lead in the government of Petrograd are described. In order to prepare this insecticide, potassium bichromate, one part by weight, and lead acetate two parts, were dissolved separately and by mixing the two solutions together, acid chromate of lead was obtained in the form of an amorphous floccular precipitate. This insecticide was tested in various strengths, from 5 oz. to 10 oz. in 27 gallons of water, upon caterpillars of *Pieris brassicae* and *rapae*, upon the larvae of *Nematus septentrionalis*, and on the adults of the beetle, *Agelastica alni*. The insecticide was retained satisfactorily on the foliage of apples, birches and alders, but on cabbages, it was necessary to add molasses. No damage to the trees was observed, but the insecticide proved very slow in its effect and though the insects ceased to feed on the sprayed plants, the death-rate was very low. It is considered remarkable that an insecticide consisting of two poisonous substances should prove so harmless to insect pests and the necessity for further experiments with this substance is indicated.

During the discussion, Prof. E. M. Vassiliev stated that his experiments with this insecticide showed that it does not adhere satisfactorily to foliage and that it had had no effect on *Athalia spinarum*. I. V. Emelianov referred to the good results obtained by this preparation in India by Lefroy and others.

Uvarov (B. P.). **Ближайшія перспективы въ техникѣ борьбы съ саранчевыми.** [The immediate prospects in the technique of the fight against locusts.] pp. 53–60.

With regard to this paper [see this *Review*, Ser. A, iii, pp. 98–99] it was pointed out at the Conference by Th. N. Lebedev that sodium

arsenate has some advantages over sodium arsenite, as it does not cause scorching or absorb moisture. L. D. Moritz stated that the effects of sodium arsenite are not always constant and that sprayings with it frequently require to be repeated.

VITKOVSKY (N. N.). **Стеблевая совка въ Екатеринославской губерніи по даннымъ 1914 года. Распространеніе, біологія, практика борьбы.** [*Oria musculosa*, Hb., in the govt. of Ekaterinoslav, according to the data for 1914. Distribution, biology and method of control.] pp. 61–71.

Oria musculosa has reached the government of Ekaterinoslav from the south, from Taurida and probably also from the province of the Don. Up to the present it has spread only in the districts situated to the east of the river Dnieper. The statement by K. K. Miller that, in 1912, *O. musculosa* was injurious in some parts of Ekaterinoslav, to the west of the river, is not correct and was based on erroneous reports from local correspondents who mistook *Anisoplia austriaca* for this insect. Thus the Dnieper has up till now proved an efficient barrier against this pest, and this confirms the statement of Mokrzecki, that these insects are unable to fly over large open areas. In one district, a railway line barred the progress of the insects, the localities situated to the east, north-east and south-east of this line being free from them, while in another locality, a highway planted on both sides with woods formed a clear boundary between devastated and untouched fields.

In 1914, this pest injured many tens of thousands of acres in five districts of the government, summer-sown crops being in some cases totally destroyed, and the same has also happened to some degree with winter-sown crops. It has spread very greatly since 1910, and is still doing so.

The life-history of this pest is given in some detail [see this *Review*, Ser. A, ii, p. 391]. Contrary to the usual statements that the caterpillars only move about at night, the author has frequently observed them passing from one plant to another during the hottest time of the day. *Bracon abcissor*, Nees, and some allied parasites have been reared from the caterpillars. These BRACONIDAE, which are found from the government of Charkov to the Sea of Azov, destroyed enormous quantities of the caterpillars and evidently attacked them during their passage from one plant to another. The majority of the dead caterpillars were found inside the sheaths of the ears, but they also frequently occurred in the young stems. From 100 pupae taken in the open, 6 Hymenopterous parasites were reared, including *Anomalon latro*, Schr. Oviposition was found experimentally to take place on the stems of summer-sown wheat beneath the sheath leaf; eggs were not laid lower than 7 inches from the surface of the soil. No eggs were ever observed to be deposited on stubbles, and in Ekaterinoslav it is impossible for this to occur, as there are no stubbles during the time of year at which the adults are on the wing. At the same time, eggs may possibly be found on the stubbles of summer-sown crops, though these would have been deposited on the crops and remained on the stubbles after the harvest. As regards weeds, the eggs are usually deposited on *Agropyrum* and only occasionally on *Setaria*; on weeds, the eggs are laid exclusively on the lower part of the stem. One

experiment in attracting the imagines with molasses and yeast was made, which, although not quite successful owing to the rainy weather, demonstrated that the moths find this substance attractive. In the course of the discussion on this paper, V. G. Averin recorded the occurrence of this pest in Charkov on fields of summer-sown wheat, barley and oats over an area of 39,000 acres. In some cases where the fields were re-sown, they were again destroyed. He recommended mowing the attacked crops and burning them, or, when the number of caterpillars was not great, feeding cattle with the crop. S. A. Mokrzecki reviewed the outbreaks of this pest, dating from that observed by Lindeman in 1882, in the province of Kuban. He had bred 5 species of parasites of this pest, the most important being a species of *Trichogramma*, and had also obtained a secondary parasite, *Anthrax hottentotus*, L. (*flavus*, Meig.). L. D. Moritz reported that in 1911 there was an outbreak of this pest in the government of Orel, on winter-sown rye. G. S. Sudeikin referred to the damage caused by it in the province of the Don, in the government of Voronezh, where some 5 per cent. of the crops were injured, and in the government of Tambov, where it is specially injurious to wheat sown in strips, which method of sowing also favours attack by other pests, such as Hessian fly, eel worms, etc. A. A. Silantiev reported that in North Russia, in the governments of Tula and Novgorod, caterpillars of *Trachea* (*Hadena*) *secalis* are found on rye and injure some 10 per cent. of the crop, both the caterpillars and the injuries caused by them being similar to those of *O. musculosa*. A. A. Yatchevsky called attention to the control of this moth by means of fungoid diseases and asked for materials to be sent to the Bureau of Mycology.

PORTCHINSKY (I. A.). **Очеркъ распространенія въ Россіи важнѣйшихъ вредныхъ животныхъ въ 1913 году.** [A review of the spread in Russia of the chief injurious animals in 1913.]—Reprint from **«Ежегодникъ Департамента Земледѣлія за 1913 г.»** [*Year-book of the Department of Agriculture for 1913*], *Petrograd*, 1914, 14 pp., 4 figs.

The author refers first to the campaign against locusts which was conducted in 1913 chiefly in the government of Tobolsk (Siberia) and also in Central Asia and Caucasia, and to the favourable results obtained by means of chemical remedies, such as spraying with Paris green and other insecticides. In the southern part of European Russia there was again, in 1913, an outbreak of *Phlyctaenodes sticticalis*, the caterpillars of which attacked mostly beets and meadow plants; reports from various governments showed however that this pest was largely dying out in some places owing to the infertility of the females of the second generation, as well as from other causes. *Oria musculosa* did great damage in 1913 to crops in Ekaterinoslav and in the province of the Don. Other important pests in South Russia were *Trachea* (*Hadena*) *basilinea* and *Barathra* (*Mamestra*) *brassicae* in Charkov, and *Brachycolus noxius* in Taurida. In North Russia, the chief pests recorded were the Noctuids, *Tholera popularis*, F., (*Charaeas graminis*), which destroyed grasses in some parts of Vologda, *Euxoa* (*Agrotis*) *segetum* and *Feltia exclamationis*, which did much harm in Kazan, Viatka, Olonetz, and Perm. With regard to *Agriotes* sp., the observations of the

station of Kaluga have shown that poisoned beet is the best bait for this pest, and that basic slag spread in lines is very effective in protecting the crop [see this *Review*, Ser. A, ii, p. 263]. *Sitones lineatus* has been injurious in many places specially in the governments of Tambov and Penza. Clover in Ufa, has largely suffered from *Apion* sp. Mustard in Astrachan, was attacked by various pests [see this *Review*, Ser. A, ii, p. 355], and rape in Bessarabia and elsewhere was injured by *Athalia spinarum* and *Entomoscelis adonidis* [see this *Review*, Ser. A, i, p. 395]. Oats and barley in Bessarabia have suffered considerably from *Lema melanopa*, owing to the wet summer. *Schizoneura lanigera*, which was previously known in the Crimea, Caucasus and in Central Asia, was discovered in the year under report in Bessarabia, having been evidently imported from Rumania. A serious outbreak of *Lymantria dispar* occurred in the Crimea, and the multiplication of *Clysia ambiguella* on vines in Bessarabia was favoured by the wet weather in 1911 and 1912. Experiments in the control of *Cydia pomonella* by means of the parasite *Pentarthron* (*Trichogramma*) *semblidis*, by Radetzky in Turkestan and Dobrovliansky in Kiev, and the author's own work on the importance of *Phalera bucephala* for the artificial multiplication of this parasite during winter [see this *Review*, Ser. A, i, p. 317] are referred to.

Baume-Pluvinel (G. de la) & Keilin (D.). **Sur la destruction épidémique des colonies de Pucerons par un Braconide, *Aphidius avenae*, Haliday.** [An epidemic destruction of aphid colonies by a Braconid, *Aphidius avenae*, Haliday.]—*Bull. Soc. Entom. France, Paris*, no. 17, 1914, pp. 464–465.

Aphid colonies which appeared on *Cirsium* and *Artemisia* about the middle of June in Paris, were attacked and almost exterminated by a Braconid, *Aphidius avenae*, Hal. The infested Aphids migrated to low-growing plants.

De Stefani [Perez] (T.). **Insetti occasionalmente dannosi alle viti.** [Insects occasionally injurious to the vine.]—*Palermo*: Tipografia G. di Giorgi, 1914, 14 pp.

Oryctes nasicornis var. *grypus*, *Labidostomis taxicornis*, *Aphrophora spumaria* and *Icerya purchasi* have only lately been noticed injuring the vine in Sicily, so that they may be considered to be occasional pests, many of which are included in the following list of the known insect pests of the vine :—Coleoptera: *Melolontha melolontha*, L.; *Phyllognathus silenus*, F.; *Anomala aenea*, Deg.; *A. vitis*, F.; *A. solida*, Er.; *A. ausonia*, Er., var. *sicula*, Gnglb.; *Rhizotrogus euphytus*, Buq.; *R. ciliatus*, Reiche; *R. tarsalis*, Reiche; *Geotrogus* (*R.*) *sicelis*, Blanch.; *Epicometis hirta*, Poda; *Oxythyrea* (*Leucocelis*) *funesta*, Poda; *Coeliodes inequalis*; *Otiorrhynchus ligustici*, L.; *O. tristis*, Scop. (*nigritus*, F.); *O. sulcatus*, F.; *Byctiscus betulae*, L. (*Rhynchites betuleti*, F.); *Vesperus xatarti*, Muls.; *Purpuricenus koehleri*, L., var. *aetnensis*, Bassi; *Adoxus obscurus*, L.; *Haltica ampelophaga*, Guér. Hymenoptera: *Macrophya rufipes*, L.; *Vespa vulgaris*, L.; *V. germanica*, F.; *V. orientalis*, F.; *V. crabro*, L.; *Polistes gallica*, L.; *Lasius alienus*, Foist. Lepidoptera: *Chaerocampa* (*Deilephila*) *elpenor*, L.; *Procris* (*Ino*) *ampelophaga*, Bayle;

Arctia (*Chelonia*) *caja*, L.; *A. villica*, L.; *Diacrisia* (*Spilosoma*) *lubricipeda*, Esp.; *Euxoa* (*Agrotis*) *tritici*, L., var. *aquilina*, Hb.; *E. obelisca*, Hb.; *E. crassa*, Hb.; *E. segetum*, Schiff.; *Agrotis pronuba*, L.; *A. orbona*, Hüfn.; *Tryphaena* (*A.*) *fimbria*, L.; *Cryptoblabes* (*Ephestia*) *gnidiella*, Mill. (*Albinia wokiana*, Briosi and *A. casazzae*, Briosi); *Sparganothis pilleriana*, Schiff.; *Clysia* (*Conchylis*) *ambiguella*, Hb.; *Polychrosis* (*Eudemis*) *botrana*, Schiff.; *Antispila rivillei*, Stt. Diptera: *Janetiella* (*Perrisia*) *oenophila*, Haimh.; *Ampelosucta illata*, Dest.; *Drosophila melanogaster*, Mg. (*ampelophila*, Lw.). Rhynchsta: *Nysius senecionis*, Schitt.; *Phylloxera vastatrix*, Planch.; *Pulvinaria vitis*, L.; *Margarodes vitium*, Giard; *Pseudococcus vitis*, Niediel. Orthoptera: *Dociostaurus maroccanus*, Thunb., *Caliptamus italicus*, L., *Phaneroptera falcata*, Poda, *Tylopsis thymifolia*, Pet. (*lilifolia*, F.), *Ephippigera ephippiger*, Fieb.; *Oecanthus pellucens*, Scop.; *Brachytrypes megacephalus*, Lef. Isoptera: *Calotermes flavicollis*, F.; *Leucotermes lucifugus*, Rossi. Acari: *Eriophyes vitis*, Nal.

Le malattie del Pesco e la loro cura. [Diseases of the peach and their cure.]—*L'Agriculture Pratico, Genova*, vii, no. 11, November 1914, pp. 4–6.

In the Province of Ravenna, a mixture of grease and petroleum is spread on paper and placed round the base of the trunk of peach trees in order to keep away the ants which accompany aphids. A rag placed between the bark and the paper effectually prevents the mixture from reaching the former and causing injury.

Norme per la difesa delle piante nella Colonia Eritrea. [Plant protection regulations in the Italian Colony of Eritrea.]—*Agric. di Terra di Lavoro, Caserta*, iii, no. 11, November 1914, pp. 12–14.

The regulations proclaimed on the 13th July 1914, provide for the inspection of all horticultural establishments or nurseries in the Colony of Eritrea. The importation of plants and seed from Italy is prohibited, unless the shipment be covered by a certificate of origin attesting it to be free from such diseases as may cause injury in the Colony. Importation from abroad is prohibited generally; the Director of Agriculture may under exceptional circumstances permit such introduction, provided his representative finds no trace of disease. Infected plants are subject to destruction without compensation. The penalties range from 8*s*. to £8 without prejudice to action under the Italian Penal Code.

Smulyan (M. T.). **The Marguerite Fly** (*Phytomyza chrysanthemi*, **Kowarz**).—*Massachusets Agric. Expt. Sta., Amherst*. Bull. no. 157, November 1914, 52 pp. 3 plates.

The ravages of *Phytomyza chrysanthemi*, Kowarz, (the Marguerite Fly or Chrysanthemum Leaf-Miner), have, in many instances, stopped the growing for commercial purposes of marguerites and other Compositae in Massachusetts. This insect, also called chrysanthemum fly, marguerite leaf-miner and marguerite daisy fly, was first detected in the United States in 1886. It has also been reported from Pennsylvania, Connecticut, New Hampshire, Montana and Wisconsin.

This insect was at first confused with various European species, such as *Phytomyza affinis*, Fallen, *P. lateralis*, Fallen, and *P. nigricornis*, Macq., from which it is now considered distinct. Under the name *Napomyza chrysanthemi*, a serious outbreak of it in Milwaukee was reported by Sanders [see this *Review*, Ser. A, i, p. 55]. The first indications of injury are seen in minute, pale spots on the leaves, which develop into papillae, being generally more numerous on the upper side. These are produced by the female in feeding or ovipositing. The real damage is, however, caused by the larva, which mines beneath the epidermis, mostly of the upper surface of the leaf. The wide distribution of this pest and the large number of commercially grown plants which it attacks enhance its importance. Descriptions of the adult and larva are given. These flies seem to be incapable of long-sustained flight. It was found experimentally that the life of the males ranged from four to thirty days and that of the females from eleven to forty-seven days. The larvae may feed as long as seventeen and eighteen days. Pupation takes place within the larval mine and lasts, as a rule, from thirteen to fifteen days. Until recently, the picking and destruction of the infested leaves was the only control known, inadequate though it was. This insect is best controlled by spraying with nicotine solutions such as "Black Leaf 40," "Nico-Fume" Liquid and "Nicotide," diluted from 400 to 450 times in water, and applied at intervals of eleven or twelve days, or somewhat oftener if the temperature of the greenhouse is higher than that at which marguerites are usually kept. Black Leaf 40 should be used with 400 parts of water, at first; later, especially if the spraying is done regularly, 1 part to about from 430 to 450 parts of water, which is the strength at which "Nico-Fume" Liquid is also used. A bibliography of 12 works is given.

Davis (J. J.). **The yellow clover aphis.**—*U.S. Dept. Agric., Bur. Entom., Washington, D.C.*, Tech. Ser. no. 25, pt. ii, 12th November 1914, pp. 17–40, 6 figs., 1 pl.

The yellow clover aphis, *Callipterus trifolii*, Monell, is common and sometimes abundant throughout the eastern half of the United States, except possibly in the extreme southern portions, although it has never been considered a pest there and consequently its life-history and habits have been but little studied. *Callipterus trifolii* was first described by Monell in 1882, and in 1899 Buckton redescribed it under the name of *Chaitophorus maculatus* from specimens collected in India on lucerne. It is probably identical with *Aphis ononidis*, Kalt., (1846) and if so, this name will have priority. In the United States, the universal food-plant of this species is red clover, *Trifolium pratense*, but it has also been reared on white clover, *T. repens*. In 1909, Parks conducted a series of experiments to test the ability of *Callipterus trifolii* to live on various plants, and it was found to breed without difficulty on alsike, English and mammoth clovers (all species of *Trifolium*). In India it lives on lucerne, *Medicago sativa*, but is not reported there on *Trifolium*. A full description is given of this aphid, of which a number of generations of winged and wingless viviparous females are produced during the summer, the winged sexual forms appearing in autumn. This species does not

appear to have an alternate host, nor does it ever pass the winter, in the latitude of La Fayette, Ind., as a viviparous female, though it apparently does so in the Southern States. As is characteristic of this tribe of plant-lice (CALLIPTERINI) it is sporadic in its habits and the least disturbance causes it to jump from its host. This habit seems to render it almost immune from predaceous and parasitic enemies. The approximate average number of yearly generations is 12½. Crowded conditions, indicating a shortage of the food supply always resulted in the appearance of a large percentage of winged forms. In comparison with its associate on clover, *Macrosiphum pisi*, Kalt., *Callipterus trifolii* is noticeably less prolific. Weather conditions, more especially heavy rains, probably constitute the most important checks on this aphid, the aphis fungus, *Empusa aphidis*, being also a factor. Occasional specimens are found to be parasitised, though no parasites have apparently been reared from it. The larvae of three species of Coccinellids, *Megilla maculata*, De G., *Hippodamia convergens*, Guér., and *Coccinella 9-notata*, Herbst, have been observed feeding on *C. trifolii*. At La Fayette, Ind., a species of *Aphidoletes* has been reared from this Aphid in captivity, although it has never been found attacking it in the field. A bibliography of 14 works, dating back to 1882, concludes this paper.

BROOKS (F. E.). **Apple root-borer.**—*Jl. Agric. Research, Washington, D.C.*, iii, no. 2, November 1914, pp. 179–185, 2 pls.

In 1911, apple trees in West Virginia were injured by *Agrilus vittaticollis*, Rand., a beetle which had not previously been recognised as an enemy of cultivated fruit trees, though belonging to a group represented by several well-known enemies of cultivated and forest plants and trees, such as the raspberry gouty-gall beetle, *A. ruficollis*, F., the two-lined chestnut borer, *A. bilineatus*, Weber, the bronzed birch borer, *A. anxius*, Gory, and the sinuate pear borer, *A. sinuatus*, Oliv. Further observations showed *A. vittaticollis* to be generally distributed throughout the Appalachian fruit region and that it does considerable damage to young apple trees in some places. It is also recorded from Michigan, Pennsylvania and New Jersey, and probably occurs throughout the greater part of the eastern United States. The larva has been found attacking apple, pear, wild thorn, wild crab and service tree, apple and service trees appearing to be greatly preferred. The trees are injured by the slender, white larvae, which bore into the roots and lower part of the trunk, the burrows in the roots frequently extending for several feet. The larva does not bring chips or castings to the surface, as is the case with *Saperda candida*, F., the common round headed apple tree borer. The egg, which is placed rather conspicuously on the bark of the trunk, and the exit hole in the bark through which the adult escapes from the wood, are the only external marks made by the insect on the tree. The burrows of *A. vittaticollis* are of great length, that of a single larva often extending through the trunk and roots for 5, 6 or even 8 feet. Cross-sections of the burrows are oval in outline, those of full-grown larvae being about 1 by 3 or 4 mm. in diameter. Fresh burrows are usually found within half an inch of the bark, and in large trees the position of a burrow in the wood gives some clue to its age. In the

numerous old trees cut and examined during this investigation the finding of a large proportion of the burrows comparatively near the bark is taken as an indication that this insect has been on the increase for the last 10 or 15 years. In the latitude of West Virginia, oviposition occurs in May and June, the eggs being glued to the trunk a few inches above the ground singly or, rarely, in pairs. On hatching, the larva enters directly into the bark, thrusting its castings backwards into the discarded shell and so filling it that it retains its normal size and shape. The abandoned shell often adheres to the bark for a year or longer. The larva lives in the tree for nearly two years. It first bores through to the cambium, thence through the cambium down the trunk to the ground, whence it proceeds outwards along a convenient root. It then burrows abruptly into the solid wood, where the remainder of the larval stage is spent.

The larva often spends its first winter in a root not more than one-sixteenth of an inch in diameter. It is active in autumn and in early spring, probably to a considerable extent even in winter. In spring it feeds rapidly back towards the base of the root and by midsummer it has reached the centre of the root system and has begun to ascend the body of the tree. The latter part of the summer and the autumn are spent in boring upward through the trunk and in fashioning a pupal chamber. In small trees, pupation takes place within 5 to 10 inches of the ground, but in larger ones the larvae ascend higher before forming the pupal cell. In apple and pear trees about 6 inches in diameter, it is not unusual for the larva to ascend 2 or 3 feet to pupate, the ascent being made within half an inch of the inner bark. The pupal chamber is a curved and enlarged terminus at the end of the burrow, occupying a vertical position, with the convex side toward the heart of the tree. The larva is not permanently settled in its pupal cell until December, often after severe frost has occurred. The adult beetle emerges in May, through a small round hole which it gnaws in the bark. The only natural enemy known is the Ichneumon, *Xylophruridea agrili*, Viereck, which attacks and destroys the larva and pupa. One generation of the parasite appears early in spring and another late in autumn. The female is believed to pierce the bark and wood in order to reach the host. The spring brood oviposits just before the root-borer larvae pupate and the autumn brood about the time that the pupal cell is being formed. The parasitic larvae attack their host externally, those from the spring brood developing rapidly, and when full-grown, constructing cocoons which occupy the host cell. This generation passes the greater part of the warm season of the year as larvae in the cocoon. The autumn larvae develop less rapidly, some not entering the cocoon until very early in the spring. Many of the adult parasites die in endeavouring to gnaw their way through the bark. The borers in small trees are the most often parasitised, probably because they are more constantly within reach of the ovipositor of the parasite. On the average, from 25 to 40 per cent. of the root-borers are destroyed by *X. agrili*. Artificial control measures must be directed toward the protection of the trunk of the tree against the deposition of the egg, rather than by killing the borer after it begins feeding. Where paints, washes or mechanical devices of any kind are used on trees as a preventive of injury by the round-headed apple-tree borer, equal protection may

be had against the apple root-borer by treating the trunks at about the time fruit is setting in the spring. The egg laying season is of short duration and temporary wrappings of paper or burlap, or any other material that will entirely cover the lower 2 feet of the trunk for a period of 4 or 5 weeks following the blooming season of the apple, will in a large measure prevent the eggs from being laid on the bark. Treatment with sticky material or heavy paints will answer the same purpose. The common service tree in proximity to an apple orchard should always be regarded as a source of possible infestation, as the pest develops freely in it.

WEISS (H. B.). **Insects found on Nursery stock Imported into New Jersey during 1913.**—*Entom. News, Philadelphia*, xxv, no. 9, November 1914, pp. 392–395, 2 charts.

According to C. L. Marlatt, in 1912 there were imported into the United States 44,781 cases of nursery stock, of which about one-fifth entered the State of New Jersey. A list of the insects, therefore, which were imported on stock entering New Jersey during 1913 is of interest to those engaged in inspection work in other States. As a rule, it is difficult during the inspection season to ascertain what is taking place in other States and some system of co operation, whereby the different inspectors could be informed of such happenings, would be of value in putting them on their guard against certain species. Two charts appended to this paper indicate the total importations of nursery stock into New Jersey, most of which came from Holland and Belgium.

During the spring the following species were intercepted:—*Pseudaonidia paeoniae*, Ckll., on azaleas from Japan; *Pseudococcus azaleae*, Tins., on azaleas from Japan; *Parlatoria pergandii*, Comst., on maples from Japan; *Diaspis pentagona*, Targ., on *Prunus persica* from Japan; *Aspidiotus hederae*, Vall., *A. britannicus*, Newst., and *Coccus hesperidum*, L., on bay trees from Belgium.

During the autumn the shipments infested were as follows:—*Aleurodes* sp., on azaleas from Belgium and Holland, on aucubas from Holland, and on bouvardias from England; *Lepidosaphes ulmi*, L., on boxwood from Holland; TINGITIDAE eggs on rhododendrons from Belgium; *Coccus hesperidum*, L., on bay trees from Belgium; *Pseudococcus* sp., on palms and bays from Belgium, on *Metrosideros* from Belgium, and on bamboo canes from England; *Chrysomphalus aonidum*, L., and *C. dictyospermi*, Morg., on palms from Belgium; *Aspidiotus hederae*, Vall., on oleanders and palms from Belgium and on *Yucca tricolor* from England; *Diaspis boisduvalii*, Sign., on orchids from England; *Hemichionaspis aspidistrae*, Sign., on ferns from Belgium and England; the Stratiomyid, *Sargus (Macrosargus) cuprarius*, L., the Hemipteron *Salda (Acanthia) saltatoria*, L., and the Tineid moth, *Gracilaria azalea*, Busck, on azaleas from Belgium; *Peripsocus* sp., on bay trees from Belgium; *Apion ulicis*, Forster, in seed-pods of *Ulex europea* from England.

Practically all the insects, with the exception of the species of *Aleurodes*, are already more or less widely distributed in the United States. The infested plants received during the spring from Japan were destroyed, while the bay trees were cleaned by the consignees

before being sold. In most cases, the autumn infestations were not serious, *Coccus hesperidum* and the *Aleurodes* being the most numerous. During the entire year no brown-tail nests or gipsy moth egg-masses were noted.

BÉGUET (M.). **Essais de destruction du *Stauronotus maroccanus*, Thunb., en Algérie, au moyen du *Coccobacillus acridiorum*, d'Hérelle.** [Experiments in the destruction of *Stauronotus maroccanus*, Thunb., in Algeria by *Coccobacillus acridiorum*, d'Hérelle.]—*Bull. Soc. Path. Exot., Paris*, vii, nos. 8–9, 11th November 1914, pp. 651–653.

During the past two years, the action of d'Hérelle's *Coccobacillus acridiorum* on *Dociostaurus maroccanus*, the only economically troublesome locust in Algeria of recent years, has been studied [see this *Review*, Ser. A, ii, p. 681]. The power of the virus may be increased until it proves regularly fatal 3–4 hours after inoculation, the infection being chiefly spread by the ingestion of plants soiled by infected excreta. In Algeria, this locust is protected by conditions which are unfavourable to the disease, because the locusts develop in arid regions where the sparse vegetation does not lend itself to poisoning and only a small proportion of the insects exhibit cannibalistic tendencies. This method of control is, however, a useful accessory to the mechanical methods now in use, particularly in sparsely populated districts where the latter cannot well be employed.

BATTANCHON (G.). **Les jeunes plantiers et les vers blancs.** [Newly planted young vines and chafer larvae.]—*Progrès Agric. Vitic., Montpellier*, lxii, no. 46, 15th November 1914, pp. 474–475.

It has been suggested that newly planted young vines could be protected against the larvae of chafers by planting beets or potatoes between the rows as baits. This practice has often been adopted in the Beaujolais-Mâconnais district. To conserve the attractiveness of the bait, stable manure must not be used, but only chemical fertilisers. Injury may be completed before the potatoes attain to a suitable size, and in such cases lettuces provide a good substitute. In the suggestion originally put forward, the potatoes were old ones of the preceding crop and would, of course, be immediately attractive. The baits must be easily accessible to the grubs, and this is only possible in loose soils.

ROLIN (K. E.). **Какъ развести плодовой садъ и ухаживать за нимъ.** [How to plant an orchard and nurse it.]—Supplement to **«Плодоводство.»** [*Fruit-growing*], *Petrograd*, 1914, 64 pp., 42 figs. [Received 11th February 1915.]

This book, edited by V. E. Eudev, contains in a popular form, various information on the cultivation of orchards. Harmful insects are also dealt with and the usual remedies against *Anthonomus pomorum*, *Cydia pomonella*, aphids, *Psylla*, and other pests are given.

Aljabin (I.). **Нѣсколько словъ о пикировкѣ дичковъ и борьбѣ съ тлею.** [A few words on the grafting of wild stocks and the control of plant-lice.] — « **Плодоводство.**» [*Fruit-growing*], *Petrograd*, no. 10, October 1914, pp. 680–685. [Received 11th February 1915.]

Gryllotalpa gryllotalpa is mentioned as a serious danger to grafting, as it feeds on the roots of the wild stocks. Against aphids, washing the bushes, especially the budded parts, with green soap is recommended. About $1\frac{1}{2}$ lb. of soap in 3 gallons of water, well stirred with a brush or a bundle of twigs so as to obtain a lather, makes a good wash.

Charin (I.). **Извлеченіе изъ отчета о дѣятельности Карасубазарскаго Отдѣла Императорскаго Россійскаго Общества Плодоводства за 1911 и 1912 гг.** [Report on the work of the Karasubazar (Crimea) Branch of the Imperial Russian Society of Fruit-growing for 1911 and 1912.] — « **Плодоводство.**» [*Fruit-growing*], *Petrograd*, no. 10, October 1914, pp. 647–653. [Received 11th February 1915.]

Some of the fruit-growers in the Crimea now use California mixture [see this *Review*, Ser. A, ii, p. 209–210], instead of other fungicides and insecticides, such as Bordeaux mixture, tobacco extract, etc., owing to the good results obtained with it. In the campaign against *Hyponomeuta malinellus*, *Cydia pomonella*, etc., about 5 ozs. of Paris green are usually added to 27 gallons of this liquid.

Balabanov (M.). **О борьбѣ съ личинками майскаго жука.** [On the control of the larvae of *Melolontha*.]— « **Плодоводство.**» [*Fruit-growing*], *Petrograd*, no. 10, October 1914, pp. 673–676. [Received 11th February 1915.]

It is stated that nurseries and orchards situated in open "steppe" localities, where no forests exist in the neighbourhood, are rarely subject to attack from larvae of *Melolontha*, or if attacked, the damage done is very slight; on the contrary, where orchards or nurseries are situated close to forests, especially those containing maple and ash trees, which serve as food for the imagines, the damage is serious. In the presence of these two trees, the orchards and nurseries suffer even when situated at a distance of as much as two miles from them, and it is considered useless to attempt to plant orchards in such cases. The larvae destroy the roots of the stocks, and of bush-fruit, especially raspberries and strawberries, as well as beet and potatoes. In the case of potatoes, recent manuring with dung aggravates the evil.

The author has unsuccessfully tried fumigation during the time when the imagines are on the wing, so as to prevent them from ovipositing; nor has he obtained favourable results by keeping the seedlings for some time before planting in soil containing kerosene and in watering the spaces between the beds with water containing kerosene. The digging out of the attacked stocks, followed by the hand-picking of the larvae, as well as poisoning the larvae with baits consisting of buried grains of maize poisoned with corrosive sublimate, were also not effective; potatoes planted between the trees in the nurseries were not of much use as traps, although they attracted some of the larvae.

Balabanov (M.). **О медяницѣ (медянкѣ).** [On *Psylla mali*].—**«Плодоводство.»** [*Fruit-growing*], *Petrograd*, no. 11, November 1914, p. 786. [Received 11th February 1915.]

The author disagrees with the statement by Lakin, that the copulation and oviposition of *Psylla mali* was observed on 26th March, as in his experience this process takes place in autumn. This species hibernates in the egg stage, the eggs hatching in March in South Russia, or in April in Central Russia.

Pierce (G. W.). **The Almond.**—*Mthly. Bull. Cal. State Commiss. Hortic.*, *Sacramento*, iii, no. 11, November 1914, pp. 456–465, 2 figs.

This paper is chiefly cultural, only a small part being devoted to insect pests. The larva of the peach moth at times does much damage to the almond crop, if neglected. If it appears, it should be treated with a mixture of Paris green and lime in the proportion of about 1 to 20, applied with a dust-spraying apparatus. Red spider [*Bryobia*] is the most persistent pest of the almond, but spraying with sulphur is very effective against it. The sulphur should be mixed with lime, as a carrying medium, in the proportion of 25 to 50 per cent. sulphur. If sulphur is to be applied at the same time that the peach moth needs attention, Paris green may be added to the sulphur and lime mixture. The dry spray is much more economical in its application than the liquid one, is far less disagreeable to the operator, and has generally proved itself effective when properly applied. For a dry spray use: lime, 40 pounds; sulphur, 5 pounds; and Bordeaux mixture, 3 pounds.

A home-made mixing machine is easily constructed with any good heavy barrel. A hole should be bored in the middle of each head, and a round shaft put completely through the barrel, leaving it to project at each end far enough to provided bearings on which to revolve, a crank being fixed at one end. A door must be cut in the middle of the barrel at the point of greatest diameter, so fixed that it can be tightly fastened. The dust-spray is best effected with specially prepared machines of various sizes, the larger ones being worked by gasolene engines. The smaller are made to run by a chain, geared to a sprocket which is attached to a wagon wheel, and are cheap and easy to operate.

The dust-spray should be used early in the morning while the dew is on the foliage and when there is but little wind. The work should be begun on the side of the orchard from which the wind is blowing, and the wagon driven along each fourth row. The machine will blow the spray high into the air and in settling it will be distributed over all the adjacent trees. This operation should be repeated several times each season, along different rows on each occasion.

Maskew (F.). **A leak in our quarantine.**—*Mthly. Bull. Cal. State Commiss. Hortic.*, *Sacramento*, iii, no. 11, November 1914, pp. 465–467, 2 figs.

In this short illustrated article it is pointed out that the cotton crop of California, which is at present free from insect pests and diseases, should be protected from the cotton boll weevil [*Anthonomus grandis*]

and the pink boll worm [*Gelechia gossypiella*] by legislation enforcing quarantine and inspection of postal packets, cotton-seed sometimes being sent in this way.

WHITNEY (L. A.). **A little known orchid pest (*Isosoma orchidearum*, Westw).**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iii, no. 11, November 1914, pp. 483–485, 4 figs.

Isosoma orchidearum, Westw. (EURYTOMIDAE), popularly known as the Cattleya fly, as it confines its attacks to that family of orchids, is one of the worst insect pests to which these plants are subject. The life-history and habits of this insect are little known. Where the egg is deposited, is uncertain, but from the character of the ovipositor, it is supposed to be inserted in the tissues at the base of the bulb, and the larvae on hatching bore their way into the centre of the bulb and devour the heart, causing distortion. Short, popular descriptions of the egg, larva, pupa and adult are given. The entire metamorphosis appears to occur inside the bud, the adult gnawing its way to the exterior.

The eradication of this insect is difficult, as orchids under artificial conditions are in a state of growth nearly all the year. This favours the development of the insect, the generations of which are continually overlapping. Control measures such as injecting nicotocide into the infested bud, or piercing the larvae with a triangular dissecting needle have been tried from time to time, but apparently with no great success. The most practical measures are constant watchfulness, fumigation with a vaporising insecticide for the adults, and the cutting and burning of infested buds. In view of the wide distribution and destructiveness of this insect, persons contemplating the importation of orchids should insist on the most thorough certifications and inspections.

Insect Notes.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iii, no. 11, November 1914, p. 489.

Oranges and a number of native shrubs from Tahiti infested with *Morganella maskelli*, Ckll., are constantly intercepted in quarantine at San Francisco, and there is little doubt that this scale would become a serious citrus pest if once it was established in California. The walnut mealy bug, *Pseudococcus bakeri*, is very injurious in a few vineyards, where *Typhlocyba comes*, Say (the grape leaf-hopper) also occurs in great numbers. The State Insectary has released a colony of *Leptomastix* sp., a new internal parasite of *Pseudococcus citri*, Bern., in the infested orchards of Southern California; while *Coccophagus orientalis*, How., an internal parasite of *Saissetia oleae*, Bern., has been recovered from a colony released in the late spring. Several thousand adults of *Scymnus bipunctatus*, a predator on *P. citri* introduced from the Philippines, have also been sent to Southern California.

BREMNER (O. E.). **Fall Treatment for Apple Aphis.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iii, no. 11, November 1914, pp. 480–482.

Aphis sorbi (the purple apple aphis) is unquestionably the most destructive species in Sonoma county, California. This species hatches early in the spring, the exact period varying with the condition

of individual trees. This fact renders control difficult, as, if the aphid is not killed within less than a week from hatching, the damage to the crop is practically accomplished. The newly-hatched aphid attacks the developing leaves and fruit-buds, causing the leaves to curl so that the insects within are protected against spraying. The stem-mothers give rise to several generations of parthenogenetic females, and during the warm weather in June winged females appear and migrate to an intermediate host. No aphids can be found on the trees from this time until about the middle of October, when winged viviparous females appear on them. The identity of the intermediate host is uncertain, but aphids have been found on Careless Weed, *Amarantus retroflexus*, at the time the viviparous females appear. Winged males appear soon after the winged females. Egg-laying begins with the first hard frosts, towards the end of November.

In order to destroy the sexual females before they oviposit, an autumn spraying between the 15th and 25th of November was tried, this time being also a convenient one for the grower in other ways. Good results were obtained with 4 per cent. crude oil emulsion, and in another case, distillate emulsion 3 per cent. and black leaf 40, 6 oz. to 100 U.S. gals. (83 gals. Impl.), used on about 200 trees also gave good results. An application of $12\frac{1}{2}$ per cent. crude oil emulsion late in December was as effective as the spring treatment.

In the autumn of 1914 it was proposed to use the $12\frac{1}{2}$ per cent. crude oil emulsion as near the 25th November as convenient, and by this means, not only to destroy the sexual females of the purple aphis, but also the eggs of the green aphis, of the tussock-moth, San José scale, etc. The same spray gave excellent results against *Aphis prunifoliae* (prune aphis) and *Eulecanium armenaicum* (brown apricot scale) in 1913. In the case of prune trees, this need only be repeated every three years, and possibly only every other year in the case of apples. Growers are advised to make their own crude oil emulsion, as it is cheaper and more effective. The paper concludes with the following two formulae :—

(i) Crude oil emulsion formula. Place 88 U.S. (73 Impl.) gallons of water in the spray-tank and add 1 to 2 gallons, depending on the softness of the water used, of liquid soap diluted with about an equal amount of water ; agitate until thoroughly mixed and then, with the agitator running, add 10 U.S. ($8\frac{1}{3}$ Impl.) gallons of crude oil.

(ii) Whale oil soap formula. Slice and dissolve 10 lb. whale oil soap in not less than 10 U.S. gallons of water by boiling ; add this to about 10 U.S. gallons of water (already in the spray tank) ; thoroughly agitate and add enough water to make 90 gallons ; then add 2 lb. caustic soda (concentrated lye) dissolved in water, and with the agitator running add slowly 10 U.S. gallons of crude oil.

URICH (F. W.). **Entomologist's Report.**—*Minutes of the Meeting of the Trinidad Bd. Agric.* no. 9, 20th November 1914, p. 45.

In the Toco district, *Steirastoma depressum* (cacao beetle) and thrips were present in small numbers in isolated spots in exposed positions. In the Sangre Grande district, thrips showed a tendency to increase and spraying would be advisable in dry weather. At the beginning of the month, no signs of froghoppers, *Tomaspis saccharina*, were to be seen at Esperanza Estate.

Rutherford (A.). *Stauropus alternus*, **Wlk., the Lobster Caterpillar.**—*Trop. Agric., Peradeniya*, xliii, no. 5, November 1914, pp. 380–381.

The lobster caterpillar, *Stauropus alternus*, Wlk., appears to be confined to single bushes of tea. Green, however, records a case where a considerable acreage was destroyed in 1903. In addition to tea, it has been recorded as feeding on cacao, mango, *Albizzia stipulata*, *Acacia decurrens*, *Grevillea robusta*, roses and other plants. A description of the caterpillar is given. In the case of a severe infestation, when the caterpillars have reached some size, it is advisable to prune the infested area and burn the prunings. Should an attack be observed when the caterpillars are small and there is still a considerable amount of foliage on the bushes, resort should be had to an arsenical spray. Pupation takes place in a loose cocoon composed of rather coarse, yellowish-white silk, spun between two leaves or in the angles of the branches. The adult moth emerges in from seven to ten days. The eggs are laid on both surfaces of the leaves, the collection and burning of which provides a further means of control. The appearance of the caterpillar and its potentialities for harm should be known to every planter.

Rutherford (A.). *Heterodera radicicola*, **Muell., or "Eelworm."**—*Trop. Agric., Peradeniya*, xliii, no. 5, pp. 381–383.

About the end of July, tea seedlings were found to be infested by eelworms, *Heterodera radicicola*, Muell., which have also been recorded in Ceylon on *Albizzia* and peas. The control measures which are used in the United States are given, steam and formalin being employed in green-houses and seed-beds, and carbon bisulphide in the field. A 1 per cent. solution of commercial formalin is used at the rate of 1 to 1½ gallons per square yard, the soil being frequently stirred before planting or replanting a week later. Deep cultivation and a liberal application of nitrogenous and potash fertilisers are useful in the field, but carbon bisulphide, flooding, or starving out are the only means of ridding the soil of this pest. To starve it out the land must be kept free from vegetation for two years, or immune plants, such as the cowpea (iron variety), sorghum and Kaffir corn, must be grown for that period. Where flooding is practicable, after all host plants have been removed, a submergence of from 15 to 20 days has given favourable results. Eelworms are very susceptible to drought, and if the ground is deeply tilled after the rains and left untilled during the dry season, their numbers will be greatly reduced. On the authority of Bessey, a list of some of the many tropical plants susceptible to attack by eelworms is given.

Osservatorio Autonomo di Fitopatologia, Turin. Mthly. Leaflets, no. 1–12, January–December 1914, 48 pp.

The four-page monthly agricultural leaflets of the Osservatorio Autonomo di Fitopatologia of Turin are each divided into two sections, the first being advice for the current month and the second a record of insect and fungus injury observed in the preceding one in Piedmont.

In the originals, the lists are arranged by order of plants. The following is a brief record of some of the injurious insects :—*Hylesinus fraxini* on cherry ; *Aulacaspis pentagona* on almond, peach, walnut, Canadian poplar, gooseberry, and other plants ; *Chionaspis euonymi* on jessamine and *Euonymus* ; *Coccus* (*Lecanium*) *elongatus* on laurel ; *Schizoneura lanigera* on apple ; *Epidiaspis* (*Aulacaspis*) *piricola* on apple and pear ; *Eriophyes* (*Phytoptus*) *pyri*, *Contarinia pyrivora*, and *Tingis pyri* on pears ; *Cydia pomonella* on pear and walnut ; *Hyalopterus pruni* and *Scolytus rugulosus* on peaches ; *Aulacaspis rosae* and *Rhodites rosae* on roses ; *Eulecanium* (*Lecanium*) *persicae* on roses and gooseberry ; *Rhabdophaga* (*Cecidomyia*) *saliciperda*, *Chionaspis salicis*, *Lepidosaphes ulmi* (*Mytilaspis pomorum*), the sawfly, *Pontania pedunculi*, and *Oberea oculata* on willows ; *Polychrosis botrana*, *Clysia ambiguella*, *Phylloxera* spp., *Eriophyes* (*Phytoptus*) *vitis*, *Byctiscus betulae* (*Rhynchites betuleti*), *Agriotes* sp., *Anomala vitis*, *Janetiella* (*Perrisia*) *oenophila* and *Tetranychus telarius* on vines ; *Melolontha melonlotha* on fir and potatoes ; *Coccus quercicola* on oak ; *Homotoma ficus* on fig ; the aphid, *Adelges laricis*, and *Enarmonia* (*Steganoptyca*) *diniana* (*pinicolana*) on larch ; *Saperda populnea*, *S. carcharias*, *Cossus cossus*, *Lina populi* and *Aegeria* (*Sesia*) *asiliformis* on poplar ; *Aegeria tipuliformis* on gooseberry ; *Lithocolletis platani* on plane ; *Adelges strobilobius* on pine ; *Cydia* (*Grapholita*) *funebrana* and *Aphis pruni* on plums ; *Ceuthorrhynchus sulcicollis*, *Tetramorium caespitum*, *Pieris brassicae* and *Barathra* (*Mamestra*) *brassicae* on cabbage ; *Heliodines rosella* and *Aricia spinaciae* on spinach ; *Saissetia hemisphaerica* on ferns ; *Bruchus pisi* on peas ; *Hylemyia antiqua* (*Anthomya ceparum*) on lettuce ; *Acidia heraclei* on celery ; *Crioceris asparagi* on asparagus ; *Agriotes lineatus* on maize.

Aders (W. M.). **Entomology in relation to Agriculture.**—*Zanzibar Protectorate Med. & Sanit. Rept. for 1913*, pp. 84–93. [Received 1st January 1915].

In Zanzibar, coconuts are attacked by *Oryctes monoceros* and, to a lesser degree, by *O. boas*. Larvae and adults of *O. monoceros* have also been taken on sugar-cane and in one case on sisal (*Agave sisalina*). Nuts dipped in Cooper's dip before planting were found to be protected against termites. The outer husks of some nuts received were smothered with a species of *Aspidiotus*, but the leaves were not attacked. Clove trees in Pemba have been killed by *Termes bellicosus* feeding on the bark of the lateral roots ; the dead branches were also infested with Bostrychids. *T. bellicosus* is the worst timber pest in the island, but does not usually attack Indian teak. Another identified termite is *Rhinotermes putorius*, Sjöst. The Bostrychid, *Dinoderus minutus*, F., reduces all structures built of bamboo to dust within a few years. Bamboo which has been soaked in water for a few days is less liable to infestation. Split bamboos painted with Cooper's dip (5 per cent.) gave good results, as all adults and larvae were destroyed. All varieties of Egyptian and American cotton grown experimentally were seriously attacked. The Lepidopterous pests included *Gelechia gossypiella*, Saund., *Earias insulana*, Boisd., *Sylepta derogata*, F., *Prodenia litura*, F., *Orgyia vetusta*, Hmp., and *Euproctis* (*Porthesia*) *producta*, Walk. The favourite food-plant of

the latter is the castor-oil plant, *Ricinus communis*, while *Hibiscus esculentus* is a host-plant of the first four species. The Rhynchota injurious to cotton included the cotton stainers, *Dysdercus superstitiosus* (also prevalent on the open bolls of silk cotton, *Eriodendron anfractuosum*), *D. fasciatus*, and *Oxycarenus albidipennis*, the Coccid, *Pseudococcus* (*Dactylopius*) *obtusus*, Newst. (also found on citrus trees) and a species of *Aphis*. The Noctuids, *Cirphis loreyi*, Dup., and *Sesamia calamistis*, Hmp., attacked maize, which is extensively grown throughout the two islands, and were also abundant in the millet areas. A Pyralid, *Chilo* sp., is the commonest borer of maize, and in some fields ruined half the crop. Another Noctuid, *Brithys pancrati*, Cyr., is a voracious feeder on lilies, and a Pyralid, *Glyphodes sericea*, Drury, was taken on gardenias. A Fulgorid insect was very prevalent on maize imported from British East Africa, swarming at the base of the leaves. Lime and ashes sprinkled on the infested leaves were a satisfactory control. Both larvae and pupae of the Noctuid, *Busseola fusca*, Hmp., were found in the main stalk of millet. *Crocidolomia binotalis*, Zell., ruined several crops of cabbages. This moth also feeds on turnip, watercress and nasturtium. Egg-plants (*Solanum melongena*) were badly infested by a bug, *Acanthocoris fasciculatus*, F. *Dacus vertebratus*, Bezzi, attacked native gourds. *Pseudococcus obtusus*, Newst., is found in abundance on the pigeon-pea (*Cajanus indicus*), which is also attacked by a longicorn beetle, *Tragocephala variegata*, Bert. To control the latter, all affected lateral branches must be lopped off and burnt, as once the larva has reached the main stem, nothing can be done. *Cylas formicarius*, F., (sweet potato weevil), is abundant and the natives were advised not to replant this crop on infested ground. *Papilio demodocus*, Esp., is a very common pest on young citrus trees ; hand-picking the larvae is efficacious against it. *Lepidosaphes* (*Mytilaspis*) *beckii*, Newm., is the worst scale enemy of citrus. Resin wash, whale oil soap, and petroleum emulsion have proved unsatisfactory, though fumigation with hydrocyanic acid gas, as carried out in Egypt, would probably be suitable on the Government plantations. *Saissetia* (*Lecanium*) *punctulifera*, Green, and *Saissetia* (*Lecanium*) *nigra*, Nietn., occur on the mango, the fruits being also often spoilt by the tunnels of *Cryptorrhynchus mangiferae*, F., (mango weevil) against which banding has been proposed as a remedy. Bag-worms, PSYCHIDAE, are very prevalent on the African almond, *Terminalia catappa*, a shade tree found throughout the two islands. Many female cases of these pests were found to be parasitised by a Tachinid and a Dermestid larva.

JOHNSTON (T. H.) & TRYON (H.). **Queensland : Report of the Prickly-pear Travelling Commission, 1st November 1912–30th April 1914.** Brisbane : Govt. Printer, 1914, 131 pp., 66 figs., fcap. Price 5*s.* 6*d.* [Received 3rd February 1915].

The authors were appointed by the Queensland Government to visit countries in which prickly-pear is indigenous, or has become naturalised, for the purpose, *inter alia*, of looking for natural enemies which might be utilised for the destruction of this plant in Queensland. The report details the eleven species of prickly-pear at present naturalised in Queensland.

Prickly-pears were found to be little, if at all, adversely affected by insect enemies in the Mediterranean region, the Canary Islands, and Hawaii, and only to a slight extent in the West Indies and in most of the localities in South America which were visited. In Ceylon, India, and South Africa, only one species, *Opuntia monocantha*, was controlled in this way, the agent being in each case wild Cochineal insects [see this *Review*, Ser. A, ii, p. 440]. In the first two countries the attacks of *Dactylopius* (*Coccus*) *confusus indicus* had been so disastrous to the host plant that extermination had been practically brought about. The other naturalised species in India, *O. dillenii* and *O. nigricans*, and in Ceylon, *O. dillenii*, were not attacked.

The most important insect enemies of cacti in America, including those in the United States [see this *Review*, Ser. A, i, p. 78] are discussed at length, and it is recommended that, for the time being, the following insects be introduced into Queensland : the Longicorn beetles, *Monilema* spp. and *Coenopaeus palmeri* ; the weevil, *Gerstaeckeria hubbardi* ; the moths, *Melitara* spp. and *Mimorista flavidissimalis* ; the Coreid bugs, *Chelinidea* spp. and *Narnia* spp. ; the wild cochineal insects ; *Cecidomyia* (*Itonida*) *opuntiae* and *Asphondylia opuntiae* ; all from the United States ; *Cactoblastis* (*Zophodia*) *cactorum*, Berg, (Argentine moth-borer) and another Phycitid, the Mendoza moth-borer, from the Argentine.

The Commission has already introduced into Queensland certain destructive wild cochineal insects, *Dactylopius* (*Coccus*) *confusus indicus*, from Ceylon, and *D. confusus capensis*, from South Africa. These have become established, and have maintained their destructive character at the Prickly-pear Experimental Station, and should exert a powerful influence in controlling *O. monocantha*. *Cactoblastis*, which is destructive to a large number of prickly-pears, including several of the Queensland species, was also brought to that State, but most of the larvae have died.

The insects whose introduction is recommended may prove more harmful to cacti in Australia than in their native homes, where they are more or less controlled by predators and parasites, and therefore cannot exercise their full influence. It is consequently a matter of great importance that these parasites should have been eliminated before admission into Queensland. The necessity for provisions by the Queensland Government, so that any of these introduced insects may receive on arrival the proper care and attention needed for their propagation, is emphasised.

The true cochineal insects, *Dactylopius coccus* and its congeners, are very closely associated with the Cactaceae and will often only live on a particular species of prickly-pear. For example, *D. coccus* will only subsist on *Opuntia cochinelifera*, Miller, and will not attach itself to *Nopalea cochinelifera*, L., to which *Dactylopius confusus newsteadi* is confined. Similarly, *D. confusus capensis*, Green, is restricted, so far as is known, to *O. monocantha*, [see this *Review*, Ser. A, ii, p. 440].

A number of other insects attack the prickly-pears, though they are not confined to them, including : *Ceratitis capitata*, Wied. ; the two mealy bugs, *Pseudococcus obscurus*, Essig, and *Rhizococcus multispinosus*, Kuhlg. ; the Cuban cactus Coccid, *Palaeococcus* sp. ; the Capsid bug, *Stylopidea picta*, Uhler ; the Scarabaeid beetle, *Trichochrous texanus*,

Le Conte; the Calandrid root-borers, *Cactophagus* spp.; the cactus aphis, *A. gossypii*; and *Tetranychus* sp. Owing to the fact that these insects attack plants other than cactus, it is considered unwise to introduce them into Australia.

Those interested in the prickly-pear problem should consult this report in the original. The numerous illustrations are mostly from photographs and a list of over 400 references to the literature on the subject is appended.

KUWANA (S. J.). **Coccidae of Japan. V.**—*Jl. Entom. & Zool., Claremont, Cal.*, vi, no. 1, 1914, pp. 1–11, 3 plates.

The following Coccids, eight of which are new, are described and the Japanese localities given for each:

Xylococcus napiformis, sp. n., on *Quercus serrata*; *Phenacoccus azalea*, sp. n., on *Azalea*; *Eriococcus festucae*, Kuwana et Fukaya (sp. n.), on *Festuca parvigluma*; *Pulvinaria citricola*, sp. n., on citrus (to which it is very injurious), *Diospyros kaki* (persimmon), *Hibiscus syriacus*, and other plants; *P. photiniae*, sp. n., on *Photinia villosa* and *Celtis sinensis*; *P. okitsuensis*, sp. n., on orange; *P. idesiae*, sp. n., on *Idesia polycarpa* and *Phellodendron amurense*; *Lecanium* (*Eulecanium*) *pseudomagnoliarum*, sp. n., on citrus; and *L. magnoliarum*, Ckll., on *Berberis nepalensis* and grape-vine, recorded for the first time in Japan.

GARINO-CANINA (D. E.). **Osservazioni sulla sviluppo degli insetti ampelofagi e sui mezzi impiegati per combatterli.** [Notes on the development of vine pests and on the controls used against them.] —*R. Staz. Sperimt. Enologica, Asti*, December 1914, 12 pp.

Polychrosis botrana was the only species of vine-moth observed during 1914 by the entomological observatory at Asti. Besides birds, bats should be encouraged, as they devour large numbers of these moths. If the vines are supported by canes, the tops of the latter should be burned, as they harbour numbers of pupae [see this *Review*, Ser. A, ii, p. 679]. Decortication and the burning of the resulting débris should also be carried out. It has been stated that *Chrysopa vulgaris* devours the young caterpillars of *Polychrosis*, but though the development of *C. vulgaris* was studied, no confirmation of this statement was obtained.

TURNER (C.). **The Banding of Fruit Trees.**—*Gardeners' Chron. London*, lvi, no. 1458, 5th December 1914.

The practice of banding fruit trees is objected to on the ground that this method is restricted to standard trees, being inapplicable to bush trees, and that the female moths are frequently carried up into the trees by the males, thus rendering the process incompletely successful.

FEDOROV (D. V.). **Опасный вредитель ячменя.** [A dangerous pest of barley.]—**« Хуторянинъ. »** [*Chutorianin*], *Poltava*, no. 47, 3rd December 1914, pp. 1278–1279.

During the summer of 1914, barley in South and South-East Russia suffered considerably from the Swedish fly [*Oscinis frit*], resowing of the infested plots with millet, maize or sunflower being necessary in many cases. Late-sown barley was particularly damaged, and the same was the case in estates without rotation of crops where the fields had been sown the previous year with barley, oats or wheat. Steam ploughs are the best remedies against these pests, as the frequent disturbance of the soil tends to destroy the larvae and pupae ; it is important also to scarify the stubbles at the end of summer and to plough deeply before the winter ; all waste and rubbish must also be removed from the fields. Sometimes crops attacked by the pests can be saved by means of a thorough harrowing when the plants are from 3 to 5 inches high, which not only assists their growth, but also destroys large numbers of the larvae.

Состояніе озимыхъ всходовъ къ 1-му ноября 1914 г. [The state of the winter-sown crops to the 1st November (14th November) 1914.]—**« Извѣстія Главнаго Управленія Землеустройства и Земледѣлія.»** [*Bulletin of Central Board of Land Administration and Agriculture*], *Petrograd*, no. 47, 6th December 1914, pp. 1129–1132.

From the reports of over 8,000 local correspondents of the Board, it appears that insect pests have not done serious damage to winter sown crops, owing to the cold weather prevailing, which did not favour their development. Caterpillars of *Euxoa segetum*, reported from different localities in many governments of Central, South and East Russia, have, however, caused considerable damage in some places. Elaterid larvae were reported from Petrograd, Novgorod, Pskov, Livland, Estland, Viatka and Perm ; *Mayetiola* (*Cecidomyia*) *destructor* was observed in Podolsk, Cherson, Taurida and Ekaterinoslav ; and *Oscinis frit* in Podolsk, Smolensk and Livland.

KUNUIEV (G.). **Вредъ, причиняемый гусеницей озимой совки.** [The damage caused by the caterpillars of *Euxoa segetum*, Schiff.]—**« Южно-Русская Сельско-Хозяйственная Газета.»** [*South Russian Agricultural Gazette*], *Charkov*, no. 45, 10th December 1914, p. 12.

During the autumn of 1913, the caterpillars of *Euxoa segetum* destroyed, in the Bobrovsk district of Voronezh, some 21,000 acres of crops, the damage amounting in some cases to 50 per cent. and even to 88 per cent. in one locality. The destroyed fields were reploughed in the spring of 1914 and resown with summer crops ; some peasants tried again to sow winter rye, but the caterpillars reappeared and destroyed the seedlings. Such an outbreak has not occurred in this district for many years. The local remedies applied, consisted of digging trenches round the uninvaded plots and spraying with Paris green, but the latter method could not be carried out thoroughly owing to the expense.

GOMILEVSKY (V.). **Борьба съ амбарнымъ долгоносикомъ.** [The control of *Calandra granaria*.]—**« Хуторянинъ.»** [*Chutorianin*], *Poltava*, no. 50, 24th December 1914, pp. 1350–1352.

Large outbreaks of *Calandra granaria* occurred in nearly all parts of Russia in 1914. In Little Russia and in the south-western region, the beetles of the first generation appear in June; those of the second in the first half of October. The weevils hibernate and multiply next spring, but all the other stages are also able to survive the winter and are usually all to be found in storehouses during winter and spring. General information on the biology and life-history of this pest is given and various remedies described, such as ventilation and cleansing of stores, smearing walls, ceilings, etc. with tar, disinfecting storehouses in summer, when they are empty, with chloride of lime or by spraying with a solution of aniline (10 lb. in 27 gallons of water), the latter being specially useful in cases of stores containing holes and cracks in their walls or ceilings. Careful handling is required, as aniline is poisonous, and in large stores the sprayings can be done by means of orchard sprayers. Remedies, such as placing wool-belts round heaps of grain for the weevils to hide in during the night and which can be destroyed in the morning, are also described.

TCHERABAIEV (G.). **Мои наблюденія по борьбѣ съ майскимъ червемъ (яблонная моль).** [My observations on the control of *Hyponomeuta malinellus*.]—**« Прогрссивное Садоводство и Огородничество.»** [*Progressive Gardening and Market-Gardening*], *Petrograd*, no. 50, 27th December 1914, pp. 1543–1545.

The author has been using Paris green dissolved in sal-ammoniac as an insecticide against *Hyponomeuta malinellus*, the larvae of which appeared in May 1913 in enormous quantities in his neighbourhood. To every 49 litres of water a solution of 16 grammes of green in 70 grammes of sal-ammoniac was added. The spraying was effected by means of a "Vermorel" sprayer and a bamboo, which gave very good results. The tops of the trees had to be sprayed by means of a hand sprayer. Morning and evening sprayings were the most effective, spraying during the heat of the day causing scorching. In a part of the orchard which was sprayed later, when the larvae were of considerable size, the proportion of green was increased by one-half, but this proved harmful, producing scorching.

Отвѣты. [Replies]. **« Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture and Market-Gardening*], *Petrograd*, no. 50, 27th December 1914, pp. 1557, 1559 and 1560.

Raspberries, and especially currants, are injured by *Aegeria* (*Sesia*) *tipuliformis*, Cl., the larvae of which live inside the hollowed core of the shoots, causing them to bend and break off. The imagines are on the wing in April and May, ovipositing on injured spots on the lower part of the stem, etc., and the larvae penetrate into the core in which they winter. The remedies consist in cutting away all stumps and damaged shoots, the wounds after the cutting being carefully smeared over and the rubbish burnt.

Information is also given about *Byctiscus* (*Rhynchites*) *betulae*, L. (*betuleti*, F.), which attacks leaves of pear trees. This insect occurs widely in European Russia, Siberia and Caucasia, attacking poplars, aspens, limes and hazelnuts, while in orchards they feed on the buds and later on the leaves of the apple, pear and vine. Before ovipositing, the females cut into the young shoots with their proboscis, thus causing the leaves to wither; they then roll up several such leaves, laying three or four eggs in each; the larvae hatch in one or two weeks and feed on the turned leaves, which soon drop to the earth. The adult larvae gnaw a hole in the leaves and pass into the earth where they pupate, producing beetles in August. The remedies against this weevil consist in the destruction of the rolled leaves, together with the larvae contained in them; shaking down the beetles from the trees and spraying early in spring with milk of lime (40 lb. of freshly slacked lime in 27 gallons of water).

Parks (T. H.). **Effect of Temperature upon the Oviposition of the Alfalfa Weevil** (*Phytonomus posticus*, **Gyll.**)—*Jl. Econ. Entom., Concord, N.H.*, vii, no. 6, December 1914, pp. 417–421, 1 pl., 1 table, 1 fig.

Investigations were made to determine why the infestation of *Hypera* (*Phytonomus*) *postica*, Gyll., in Utah, was less serious in 1912 than in 1911. Weather conditions were suspected and experiments were undertaken to compare the variation in mean daily temperature throughout the oviposition period of the weevils, with the rate of oviposition in confinement; accurate information was also obtained regarding the average number of eggs deposited by each female during the season. The eggs are laid in clusters of 6 to 18 inside the lucerne stems through punctures in the stem made by the proboscis of the parent, and they are also laid in dead stems of the previous season's growth. The highest record for egg deposition was reached on 18th May, which day also had the highest mean temperature of any previous to 6th June. Most of the eggs were deposited during May, the rate of oviposition declining after 1st June, but being still influenced by changes in temperature. The largest number of eggs deposited by one female was 1,184, the average being 726. In the inter-mountain country less than half the weevils probably reach maturity, many perishing in the lucerne fields after the removal of the first crop and others being carried away later by the wind. Weevils which emerged from their cocoons between the 10th and 13th June deposited eggs late in October, indicating the beginning of another generation, which was later interrupted by the approach of winter, but continued in the spring. So far as is known, all eggs deposited in the autumn either perish before hatching, or the larvae are killed by the winter.

Tower (D. G.). **Notes on the Life-History of** *Prospaltella perniciosi*, **Tower.**—*Jl. Econ. Entom., Concord, N.H.*, vii, no. 6, December 1914, pp. 422–432.

A description of the life-cycle of *Prospaltella perniciosi*, Tower, is given. As the first larval stage of the parasite becomes mature, it attacks the vital parts of its host, *Aspidiotus perniciosus*, Comst., thus

preventing the second moult of the scale from taking place. The first moult of the parasite takes place at the same time that the scale becomes a light orange colour. The second larval stage and pupa are described; some adults emerge in 3 hours, others take more than a day. The parasitised scales survive the winter in two forms: first stage scales, which contain eggs of the parasite; and second stage scales, which contain first stage parasitic larvae. Parasites in first stage scales reach maturity in from 36 to 39 days, the duration of the life-cycle of the scales being from 33 to 40 days; parasites in second stage scales matured in from 19 to 23 days. The percentage of males to females seems to be about equal; polygamy is usual, but not polyandry. Observations show that oviposition takes place all through the life of the first stage scale, that the majority of the eggs are laid early in the life of the young scale and are developed in mature second stage scales, while those eggs which are deposited late in the life of the first stage scale hatch so late in the life of the second stage that the scale would not be damaged enough to prevent it from passing into the third stage. Although large numbers of the scales may have eggs laid on them twice or more, only one parasite matures in a single scale. Since the parasites pass the winter as undeveloped and partially developed eggs in the bodies of first and second stage scales, winter spraying would kill both the scale and the parasite. *P. perniciosi* has been reported from Massachusetts, Pennsylvania and the District of Columbia. The same fungi which attack the scales also attack *P. perniciosi* in the larval and pupal stages, and a number of confined parasites died from attacks of a species of *Empusa*. The predaceous enemies of the scale, such as *Microweisea (Pentilia) misella*, are incidentally destructive to the parasite in all its stages of development except the adult, but the scale is in no way controlled by this enemy. External parasites, as *Aphelinus*, destroy both the San José scale and *P. perniciosi*. The adult parasites show both positive geotropism and phototropism, and these reactions, together with the instinct of the parasite to search for scales, doubtless accounts for the scales on the smaller and outermost branches and twigs of infested material being chiefly parasitised.

WEBB (J. L.). U.S. Bur. Entom. **Notes on the Rice Water Weevil (*Lissorhoptrus simplex*, Say.)**—*Jl. Econ. Entom., Concord, N.H.*, **vii, no. 6, December 1914, pp. 432–438, 1 pl., 1 fig.**

The adults of *Lissorhoptrus simplex*, Say, hibernate in dead grass and emergence takes place in the spring, the earliest date observed being 25th March. Dissemination from hibernating quarters probably occurs at night, weevils not having been observed in flight by day. The injury caused by *L. simplex* is described [see this *Review*, Ser. A, i, pp. 151–152]. The egg is laid longitudinally, just inside the epidermis of a rootlet and the larva feeds on the inner root-tissues. The duration of the pupal stage is probably from one to two weeks, the time occupied in reaching the adult stage from the egg being 38 days. Cage tests and field observations showed that at least a partial second generation of *L. simplex* in a season is possible. Experiments also indicated that, where a brood of weevils matures in early rice, there will probably follow a second generation in late rice. A list of

species of grasses found by experiment to be infested by *L. simplex* is given. Experiments still show that drainage is the safest method of control, and it should be begun from 2½ to 3 weeks after the first flooding and continued for a fortnight; a shorter period will not kill the larvae and a longer one will injure the rice.

WEISS (H. B.). *Agrilus politus*, Say, infesting Roses.—*Jl. Econ. Entom., Concord, N.H.*, vii, no. 6, December 1914, pp. 438–440.

Infested roses from New Jersey are stated to have been attacked by *Agrilus politus*, Say, which has hitherto only been recorded as having been bred from willow. Many of the injured roses had been imported from Holland, but no such infestation is known on roses there. The larva makes innumerable galleries in the sap-wood, travelling irregularly up the stem for from 3 to 6 inches where it constructs a pupal chamber; the outward sign of injury is a gall over the galleries, while the leaves turn yellow and wither. At one nursery in New Jersey, £40 worth of roses were destroyed by this insect; at another, the services of two men were required for over two days to cut and burn infested stock. *Rosa rugosa*, on which standard roses are usually grafted, seems to be especially attacked, though other species were also found infested. Infestations have been recorded from New Jersey, Pennsylvania, and New York. Cutting and burning of infested stems is the only method of control.

EWING (H. E.). Some Coccinellid Statistics.—*Jl. Econ. Entom., Concord, N.H.*, vii, no. 6, December 1914, pp. 440–443, 1 table, 2 figs.

Plant lice, especially *Phorodon humuli*, Schrk., *Aphis brassicae*, L., and *A. viburni*, Scop., are very destructive in W. Oregon; statistics on the relative numbers of different Coccinellids found feeding on the above three species, have been collected as a preliminary to introducing other beneficial species. All adult beetles that were present in the following situations were collected: Feeding on *P. humuli*, on hops; on *A. viburni*, on thistles and on lamb's quarters [*Chenopodium album?*]; on *A. brassicae*, on kale and vetch. The distribution of each of the following Coccinellids in these situations was then noted: *Hippodamia spuria*, *H. convergens*, *H. parenthesis*, *Coccinella 9-notata*, *C. trifasciata*, *C. transversoguttata*, *Cycloneda sanguinea* and *Adalia bipunctata*. It was found that *H. convergens*, Guér., forms the greater part of the Coccinellid population in each situation; large numbers of *C. sanguinea*, L., were found on *P. humuli* (the hop aphis) while in other situations this species was rare, being entirely absent from *A. brassicae*, on kale, and from *A. viburni*, Scop., on thistles. *H. spuria* was found to be second in numbers in four of the situations; with the exception of *C. trifasciata*, Cr., when feeding on *P. humuli*, no other species is found in such numbers as to equal or exceed 5 per cent. of the population in any one of the situations. Similar conditions prevailed in the vetch field, where *H. convergens* formed over 87 per cent. of the population, *H. spuria* came second, while *C. sanguinea*, so common in the hop fields, occurred only to the extent of about ⅓ per cent.

ILLINGWORTH (J. F.). **A New Pest of Cane in Fiji** (*Sphenophorus nebulosus*, **Macleay**). — *Jl. Econ. Entom., Concord, N.H.*, vii, no. 6, December 1914, pp. 444–445.

Sphenophorus nebulosus, Macl., a new pest of cane in Fiji, is a small weevil-borer, resembling *Rhabdocnemis obscurus*. It deposits its eggs in ruptures in the stalk, but apparently does not attack sound canes. Numerous larvae occur in parallel galleries in injured canes; the pupae are found in cavities just within the rind of the stalk, without cocoons, their smaller size distinguishing them from those of *R. obscurus*. The exposure of rotten cane to the sun for several days is suggested as the best control. This could be done either by first burning the trash, which would greatly help in the destruction or by letting the cutters throw all discarded stalks out on top of the trash.

MCGREGOR (E. A.). U.S. Bur. Entom. **The Serpentine Leaf-Miner on Cotton.**—*Jl. Econ. Entom., Concord, N.H.*, vii, no. 6, December 1914, pp. 447–454, 1 pl., 2 figs, 2 tables.

Agromyza scutellata, Fall. (*A. pusilla*, Meig.), is described particularly in its relation to cotton. In the United States, fourteen families of plants are known to be attacked by leaf-miners. The life-history of this fly, so far as it has been determined on cotton, is given: The eggs are always inserted on the upper surface of the cotton leaf, a chamber being excavated in the underlying tissue, causing a depression of the epidermis. The larva forms mines within the leaf by means of its peculiarly shaped mandibles. It makes its exit from the leaf on the dorsal surface and buries itself in the soil at the base of the stock; in a few cases only was it seen to pupate on the under-surface of the leaf. The miner first appears in cotton when the seedlings are but a few days old, generally about 1st May, complete infestation occurring by the middle of June. The activity of the leaf-miner becomes reduced towards the end of June in S. Carolina, probably owing to parasitism and aestivation; the most favourable conditions are stated to exist between 65° and 75° F., the reduction of the species beginning with a mean temperature of 77° F. *A. scutellata* is primarily an enemy of forage, but cotton fields have been noted where 98·7 per cent. of the plants were infested. One computation of the degree of parasitism showed that 24·8 per cent. were parasitised at Batesburg and 89·7 per cent. at Utah, indicating that natural enemies are more important controls in the lucerne districts of the West than in the cotton fields of the South. During these investigations on *A. scutellata* some parasites were incidentally bred, including CHALCIDIDAE—*Zagrammosoma multilineata*, Ashm., *Derostenus diastatae*, How., *Pleurotropis* sp., *Closterocerus* sp., and *Chrysocharis* sp.; BRACONIDAE—*Opius* spp.; and one Dipteron.

SWEZEY (O. H.). **The Introduction of a Tachinid Parasite of the Sugar-Cane Weevil Borer in Hawaii.**—*Jl. Econ. Entom., Concord, N.H.*, vii, no. 6, December 1914, pp. 455–457.

An account of the discovery, introduction, establishment and life-history of the Tachinid, *Ceromasia sphenophori*, Villen., is given. Colonies of this parasite were liberated in Honolulu in 1910, and

became established after about six months. In 1914, after three years, they occurred throughout the sugar-cane districts of the Philippine Islands. The extent of the reduction of the borers by the Tachinids may be seen from the fact that in 1913, 3,440 oz. of beetles were collected from a plantation, as compared with 27,010 oz. in 1912, showing a reduction of over 87 per cent. In 1914, the same plantation contained scarcely an injured cane.

FELT (E. P.). **List of Zoophagous Itonididae.**—*Jl. Econ. Entom. Concord, N.H.*, vii, no. 6, December 1914, pp. 458–459.

A record is given of predaceous CECIDOMYIDAE (ITONIDIDAE) and their hosts, which seems to show that the value of certain gall-midges as natural enemies has been overlooked. The COCCIDAE are preyed upon by the following 9 genera :—*Coccidomyia*, 2 species ; *Dentifibula*, 1 species ; *Dicrodiplosis*, 3 species ; *Mycodiplosis*, 1 species ; *Diadiplosis*, 1 species ; *Karschomyia*, 1 species ; *Lobodiplosis*, 1 species ; *Lestodiplosis*, 2 species ; *Cecidomyia*, 1 species. The APHIDIDAE are attacked by *Aphidoletes*, 5 species ; *Lestodiplosis*, 1 species ; *Itonida*, 1 species. *Tetranychus* is preyed upon by *Arthrocnodax*, 4 species ; *Mycodiplosis*, 1 species. The ERIOPHYIDAE are preyed upon by *Endaphis*, 1 species ; *Arthracnodax*, 1 species. A species of gall-midge, genus unknown, is believed to have been reared from the eggs of the Cicada, *Tibicen septemdecim*.

JONES (T. H.). **Additional Notes on Porto-Rican Sugar-Cane Insects.** *Jl. Econ. Entom., Concord, N.H.*, vii, no. 6, December 1914, pp. 461–463.

These notes are supplementary to an earlier paper on these insects [see this *Review*, Ser. A, i, pp. 184–185]. *Pseudococcus calceolariae*, Mask., is recorded for the first time from Porto Rico, all previous references to sugar-cane mealy-bugs being given under the name *P. sacchari*, Ckll. The occurrence of the Cecidomyid, *Diadiplosis* (*Karschomyia*) *cocci* on *P. sacchari* (?) is recorded. *Zelus rubidus* has been found attacking *Laphygma frugiperda*. The discovery of the Tachinids, *Linnaemyia fulvicauda* and *Compsilura oppugnator* is noted. The butterfly, *Prenes ares*, Feld., has been bred from larvae found feeding on cane leaves, as also was a species allied to *Thymelicus magdalis*, from Cuba, neither of these being, however, important sugar-cane pests in Porto Rico. *Sipha flava*, Forbes, formerly recorded as *S. graminis*, Klt. and *Aphis setariae*, Thos., have been identified. *Chrysopa collaris*, Schm., has been observed feeding on *S. flava*, while *A. setariae* is heavily parasitised by a Braconid, probably *Lysiphlebus testaceipes*, Cress., and is also attacked by *Scymnus roseicollis*, Muls. The Mymarid egg-parasite of *Delphax saccharivora*, Westw., is reported to be *Anagrus armatus*, Ashm. Two species of thrips were taken from cane leaves on which characteristic thrips injury was noted ; one i described as a new species, *Haplothrips* (?) *tibialis*, sp. n., the other being *Heliothrips femoralis*, Reuter. The mite which feeds upon sugar-cane stalks has been identified as *Tarsonemus spinipes*, Hirst, and that on sugar-cane leaves is stated to be a species of *Tetranychus* which is perhaps new.

Tartar (H. V.). On the Valuation of Lime-Sulphur as an Insecticide.—*Jl. Econ. Entom., Concord, N.H.*, vii, no. 6, December 1914, pp. 463–467.

The contents of this paper have already appeared in Research Bulletin 3 of the Oregon Agric. Expt. Sta. [see this *Review*, Ser. A, ii, pp. 543–545.]

Rust (E. W.). Notes on Coccidae found in Peru.—*Jl. Econ. Entom., Concord, N.H.*, vii, no. 6, December 1914, pp. 467–473.

The Coccidae and their hosts which have been collected in Peru are enumerated, viz. :—*Aspidiotus rapax*, Sign. (*camelliae*), is seldom a serious pest and is evidently kept in check by hymenopterous parasites ; *A. cyanophylli*, Sign., *A. cydoniae*, Comst., *A. hederae*, Vall. ; *A. juglans-regiae*, Comst., probably an introduction of the last few years, recorded once on *Juglans* sp. ; *Aulacaspis rosae*, Bouché, especially damaging roses which it often kills, it has several broods per year, and has not been noted on any other host ; *Ceroplastes* sp. (near *ceriferus*) on (?) *Mimosa* ; *Chrysomphalus* sp. n. ? (near *rossi*), on *Araucaria excelsa* and *A. bidwilli* ; *Coccus hesperidum*, Linn., attacks a large variety of hosts, but is checked by hymenopterous parasites ; *Diaspis boisduvallii*, Sign., is widely distributed and has a preference for monocotyledonous plants, especially palms ; *D. echinocacti*, Bouché, found occasionally on *Opuntia* only ; *Fiorinia fioriniae*, Targ., only collected on ornamental, cultivated plants, including *Cocos* sp., *Phormium tenax*, and *Asclepias* sp. ; *Hemichionaspis minor*, Mask., is especially a cotton pest in the cotton regions, but also occurs on other plants. *Lepidosaphes beckii*, Newm., was formerly very destructive to orange trees of which there are now few left in the area ; *Orthezia insignis*, Dougl. ; *Selinaspidus* (*Pseudaonidia*) *articulatus*, Morg., is the commonest and most widely distributed Coccid in Peru, attacking a wide range of food-plants, including *Ficus*, *Citrus* and *Rosa*, it does more damage to *Citrus* than does *Chrysomphalus aurantii* in California ; fumigation, however, is never practised in Peru and parasites do not seem to check it ; *Pseudococcus citri*, Risso, is widely distributed, but in limited numbers, and is subject to parasitic and predaceous enemies ; it has been collected on *Coffea arabica* amongst other plants ; *Saissetia hemisphaerica*, Targ. ; *Saissetia oleae*, Bern. ; collected from cotton.

Glaser (R. W.). U.S. Bur. Entom. **The Economic Status of the Fungous Diseases of Insects.**—*Jl. Econ. Entom., Concord, N.H.*, vii, no. 6, December 1914, pp. 473–476.

An account is given of the difficulties attending the artificial introduction of fungi for the purpose of controlling noxious insects. Many parasitic fungi, have been cultivated on artificial media or on living insects kept in confinement and have also been introduced among healthy insects, but the cases in which they have become established, distributed and effective are not so numerous. Spore emulsions of *Botrytis bassiana* successfully infected nun moth caterpillars [*Lymantria monacha*, L.] in the laboratory, but failed to do so in nature ; similarly *Cordyceps militaris* only gave negative results in the field.

An attempt to use *Sporotrichun globuliferum* artificially against the chinch bug [*Blissus leucoptera*] led the experimenters to conclude that where the fungus is naturally present, its action cannot be appreciably increased by the artificial introduction of spores, and that where it is not in evidence, introduced spores have no measurable effect; the absence of the fungus among chinch bugs generally means unfavourable conditions rather than lack of spores; laboratory experiments are no criterion of similar success in the field. Equally discouraging conclusions were arrived at after attempts artificially to introduce *Aegerita webberi*, Fawcett (the brown fungus), *Aschersonia aleyrodis*, Webber (the red fungus), *A. flavocitrina* (the yellow fungus) against the whitefly of citrus [*Aleurodes citri*]. *Entomophthora aulicae* (the brown-tail fungus) is stated to have been artificially used with some success against the brown-tail moth [*Euproctis chrysorrhoea*]. This fungus should be employed in the spring, early summer and autumn, warm nights and a damp atmosphere providing the best conditions. In spring, when the caterpillars are scattered over the trees, the infected larvae are easily placed among them; in the autumn, when they are localised, individual nests must be infected; autumn seems to be the best time for infection. With proper conditions for its introduction, a destruction of from 63 to 100 per cent. of the caterpillars can be depended upon.

FLINT (W. P.). **On the Capture of Living Insects by the Cornfield Ant** (*Lasius niger americanus.*)—*Jl. Econ. Entom., Concord, N.H.*, vii, no. 6, December 1914, pp. 476–478.

Lasius niger americanus has been observed to attack and kill many small insects that come near their nests. *Diabrotica longicornis*, *D. 12-punctata* and *Agonoderus pallipes*, especially the latter, are all readily killed when placed near the nests of this ant; *Chloridea* (*Heliothis*) *obsoleta* larvae, nearly full grown, were also killed, as well as *Epicauta marginata* and *E. vittata*, but Pentatomid bugs were never seen to be attacked. Examination showed that the number of Dipterous larvae in manure containing *Lasius* was much less than those in which no ants were found.

SCOTT (W. M.). **The California Pear Thrips in Maryland.**—*Jl. Econ. Entom., Concord, N.H.*, vii, nos 6, December 1914, pp. 478–479.

Taeniothrips pyri, Daniel, is recorded from a small Kieffer pear orchard near Baltimore, Md.; this is a new locality for the pear thrips, which is the most destructive fruit tree insect in California, the damage caused in the Santa Clara Valley alone, from 1904–1910, being estimated at $2,000,000. At present, the outbreak is confined to a single orchard, the pest also occurring on some neighbouring peach and apple trees, though not seriously damaging them.

ROHWER (S. A.). **Description of a New Sawfly Injurious to Strawberries.**—*Jl. Econ. Entom., Concord, N.H.*, vii, no. 6, December 1914, pp. 479–481.

A description of a new sawfly, *Empria fragariae*, sp. n., injurious to strawberries, in Iowa, is given.

Felt (E. P.). *Arthrocnodax constricta*, sp. n.—*Jl. Econ. Entom., Concord, N.H.*, vii, no. 6, December 1914, p. 481.

A description is given of a midge, *Arthrocnodax constricta*, sp. n., reared from garden beans infested with *Tetranychus bimaculatus* and probably predaceous on it.

Urich (F. W.). **Entomologist's Report.**—*Minutes of the Meeting of the Trinidad Bd. Agric.*, no. 10, 18th December 1914, p. 51.

The work undertaken against cacao beetles [*Stirastoma depressum*] consisted of spraying and cutting out the larvae, but many planters complained that some of their neighbours did nothing and so rendered their own work ineffective. On one estate, 73,000 larvae and 6,000 beetles were caught between the 1st January and the 10th December, 1914.

In connection with cacao thrips [*Heliothrips rubrocinctus*], an experiment of dusting 1,000 cacao trees with a mixture of 1 part flowers of sulphur with 10 parts of air-slaked lime, was tried early in the morning so that the mixture might adhere to the leaves when applied by means of Furet dusters. Although some of the insects were killed, many survived, and it is not considered that dusting can be used with success against thrips.

Wester (P. J.). **Current Notes: Another Nursery Pest.**—*Philippine Agric. Rev., Manila*, vii, nos. 10–12, October–December 1914, pp. 420–421.

The Capsid, *Helopeltis antonii*, Watrh., is likely to prove one of the most serious pests of all anonaceous plants, mangos, and avocados, especially in sheltered and shady situations. This bug appears a short time before the rainy season begins, and even when in small numbers, can do a considerable amount of damage. On cacao, it attacks the immature pods, which blacken and drop off. It is doubtful whether this pest can be controlled in the nursery, when on the wing, but on cacao, where the immature wingless individuals congregate on the pods, stems and branches, it is probable that they could be destroyed without difficulty by a weak contact spray.

Clement (F. M.). **Plum Culture in Ontario.**—*Ontario Dept. Agric., Toronto*, Bull. no. 226, December 1914, 32 pp., 12 figs.

In the course of this general treatise on plum culture, *Aspidiotus perniciosus* (the San José scale), *Conotrachelus nenuphar* (plum curculio), [see this *Review*, Ser. A, ii, pp. 432 and 458], shot-hole borers and aphids are mentioned as plum pests, the first being the most serious enemy of this tree. Control measures are briefly indicated. Other insects attacking the plum, which are not generally serious, are tent caterpillars [*Malacosoma* spp.], tussock moth [*Hemerocampa*], spring and fall canker worms [*Paleacrita vernata* and *Alsophila pometaria*] and the green fruit worm. A calendar outlining four sprayings concludes this section of the bulletin.

Lutchnik (V.). **No. 1. Ивовый шелкопрядъ. No. 2. Замѣтка о ловѣ вредныхъ насѣкомыхъ.** [No. 1. The Willow Moth (*Stilpnotia salicis*, L.). No. 2. Note on the trapping of insect pests.]—Reprint from «**Любитель природы**» [*Friend of Nature*], published by the Section of Agriculture and Experimental Organisation of the Kiev Society of Agriculture and Agricultural Industries. *Petrograd*, 1914, 8 pp.

In the first of these articles, the Lymantrid, *Stilpnotia salicis*, L., which is found in the whole of Europe, in the Caucasus, Asia Minor, Siberia and Japan, causing considerable damage to willow and poplar trees, is dealt with. The eggs are deposited on the bark, less frequently on leaves. As many as 70 per cent. of the caterpillars collected were infested with parasitic Diptera not yet identified, though the following Tachinids are known to be parasites of *S. salicis* :—*Carcelia gnava*, Meig., *C. excisa*, Fall., *Compsilura concinnata*, Meig., *Tachina larvarum*, L., *T. rustica*, Meig., and *Carcelia* (*Parexorista*) *cheloniae*, Rond. Some hymenopterous parasites, not yet identified, were also reared from the larvae. The usual remedies against this pest consist in destroying the eggs by scrubbing the bark and burning them or spraying with insecticides.

In the second article, the method of combating insect pests by means of trap-trenches and molasses-troughs is criticised, as it often leads to the destruction of many useful insects. In the spring of 1914, in trap-trenches against *Bothynoderes* (*Cleonus*) *punctiventris* in the government of Kiev, many useful insects were found, including the Carabids, *Pterostichus* (*Platysma*) *cupreus*, L., *Amara apricaria*, Payk., and *Ophonus* (*Harpalus*) *pubescens*, Mull., as well as *Hister fimetarius*, Herbst. All these species are enemies of *B. punctiventris*, especially the last-named. In molasses-troughs, great numbers of *Chrysopa* have frequently been found. In order to minimise this, the troughs should be removed immediately the flight of *Euxoa segetum* or other such pests is over.

Ossipov (N.). **Осеннія работы во фруктовомъ саду.** [Autumn work in orchards.]—«**Садоводъ.**» [*The Horticulturist*], *Rostov-on-Don*, no. 10, October 1914, pp. 758–764. [Received 12th February 1915.]

Autumn work in orchards to control insect pests and fungus diseases of plants is described. This consists in cleaning and pruning the trees, spraying with iron sulphate, re-digging the soil round them and applying trap-belts. The cost of such work, in the demonstration orchards of the Entomological Station of the Zemstvo of the Government of Bessarabia, is from 20*s*. to 22*s*. for an orchard of about half an acre, containing an average of from 100 to 150 fruit-trees.

Schreiber (A. F.). **Результаты двухлѣтнихъ опытовъ по уничтоженію муравьевъ.** [The results of two years of experiments on the destruction of ants.] Reprinted from «**Юго-Восточный Хозяинъ** [*South-Eastern Farmer*].—«**Садоводъ.**» [*The Horticulturist*], *Rostov-on-Don*, no. 10, October 1915, pp. 793–794, [Received 12th February 1915.]

Experiments in the destruction of ants extending over two years are described, hyposulphite of soda being the most effective means of

getting rid of this pest. Negative results were obtained with fish brine and with a 5 per cent. solution of birch-tar in boiling water. Tobacco extract gave good results, but requires much time for its preparation and repeated application. Quick-lime, although destroying a great many of the ants, does not prevent them from returning, and a solution of 10 lb. of salt in 27 gallons of boiling water had still less effect, besides being injurious to plants.

RAKUSHEV (F. N.). **Карболовая эмульсія.** [Carbolic emulsion.]—Reprinted from **«Садоводъ и Огородникъ.»** [*Horticulturist and Market-Gardener*]. **«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 10, October 1914, pp. 801–804. [Received 12th February 1915.]

The restricted use of carbolic emulsion in controlling aphids and other insect pests is attributed to the frequent scorching of leaves caused by it. These unfavourable results are due to variations in the strength of the black, crude carbolic acid usually on sale, which varies from 50 per cent. to 70 per cent. In order to safeguard against this, the solution should be tested before applying it, and the recipe given by American authors ($2\frac{1}{2}$ lb. of black crude carbolic acid and 3 lb. of potash soap in 67–70 gallons of water) corrected, so as to arrive at a solution which will destroy the pests and yet be harmless to plants. The author always obtained good results with this insecticide against Aphids, the caterpillar and imagines of *Pieris brassicae*, L., the caterpillars of *Malacosoma neustria* and the young nymphs of *Psylla mali*. Its use on roses exposed to sun is not recommended, as it may cause scorching, quassia being preferable for this purpose. Rags soaked with crude carbolic acid, renewed every two or three days, and hung on sticks drive off various insect pests.

ELLIS (W. O.). **The alfalfa weevil** (*Phytonomus posticus*, **Gyll.**)—*Washington State Agric. Expt. Sta., Pullman.* Popular Bull. no. 70, 10th June 1914, 4 pp. 4 figs. [Received 16th February 1915.]

Hypera (*Phytonomus*) *postica*, Gyll., (the alfalfa weevil) is a native of Europe, but does not do serious damage there as it is presumably held in check by its natural enemies. How the beetle was first introduced into the United States is not known, but it was first discovered in Utah, where it now is a pest; it also occurs in Wyoming and in southern Idaho, but has not yet been found in the state of Washington, where lucerne growers have frequently become alarmed at the appearance of other and harmless beetles which they have mistaken for this insect. This bulletin, which gives a popular description and life-history of this weevil [see this *Review*, Ser. A, ii, 294], is published with the object of aiding farmers to distinguish between these insects.

SCOTT (E. W.) & Paine (J. H.). **The Lesser Bud-Moth.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 113, 22nd August 1914, 16 pp., 2 pls., 1 fig., 6 tables. [Received 16th February 1915.]

During the spring of 1912, larvae damaging apple trees were identified as *Recurvaria crataegella*, Busck, but as observations by

the authors in Michigan correspond with those of Houghton in England in 1903 on *Recurvaria nanella*, Hübn., the synonomy of these two species is now accepted by Busck.

After the history of the species in Europe, and its distribution both there and in the United States, are dealt with, the European host plants of *R. nanella* are given, viz.: apricot, pear, apple, peach, plum, cherry, wild plum, and hawthorn, the pear being the favourite; it has also been recorded as seriously attacking the peach. In Michigan, the insect was reared from apple, peach, pear, plum, and sweet and sour cherries, the infestation being light on plum and cherry. In Pennsylvania, it was reared from a wild hawthorn. The Kieffer pear seems to be resistant to the attack of the young larva in the autumn or leaf-mining stage, as the mines are never developed to any great extent and the larvae die. The larvae of *R. nanella* in the spring attack both blossom and leaf-buds; the insect bores into the bud, eating the tissue, especially the young stamens and pistils of blossom-buds. As the buds open, a web is spun amongst the leaves, causing much deformation.

Eleven synonyms of *R. nanella*, as well as descriptions of the adult larva and the pupa, are given. In Michigan, the first moths issued in rearing cages on 22nd June 1913, the maximum emergence being on 30th June, and the last moths appearing on 10th July. All attempts to feed the moths in captivity failed, nor would they oviposit. In a footnote, it is stated that as this bulletin was going to press, eggs were received from Michigan, where they were obtained from moths confined in glass jars. Some were loosely deposited among the hairs on the underside of an apple leaf, for the most part along the veins of the leaf; others had been laid on a twig under the edge of a small scale. In Michigan, the eggs commenced hatching about 15th July and the larvae at once bored through the epidermis of the leaf on the underside. It is evident that the adult female in depositing her eggs lays a number at one time on adjacent leaves, as the mines usually appear in groups, several affected leaves occurring on the same or neighbouring twigs.

Upon the arrival of the first cold days of autumn, the larvae leave the mines and construct small silken hibernacula in the bark, etc., in which they pass the winter; in 1913, this commenced about 12th September and by the 17th practically all the larvae had disappeared from the mines. The hibernating larvae on large trees, even where the infestation is severe, are difficult to locate, being very small and inconspicuous. After a few warm days in the spring, they begin to appear; the first larvae were observed working in the buds in considerable numbers on 15th April. As a rule, the larvae are to be found at rest within the silken nest they spin on the opening leaves and it is therefore supposed that they are nocturnal feeders. The larval stage covers on an average a period of about 10 months; the number of moults was not accurately determined. Pupation occurs under loose bark and occupies on an average about 19 days. On large trees, where there is a great deal of roughened bark, the cocoons are difficult to find, but on young pear trees, where most of the bark is smooth, they will be found clustered in the crevices on the trunk. A few larvae pupated among the leaves and débris on the ground beneath the trees. From material collected in the larval and

pupal stages, the following hymenopterous parasites were reared: the Braconid, *Phanerotoma recurvariae*, Cushman; the Ichneumons, *Diadegma* sp., and *Itoplectis* sp.; an undetermined Pteromalid; an Encyrtid, *Eupelmus* sp.; an Eurytomid, *Eurytoma* sp., and a Chalcid, *Dibrachys* sp.

Two experiments, which are fully described, show that the lesser bud-moth can be controlled by thoroughly spraying the trees in the dormant state with lime-sulphur solution at 32° Baumé used at the rate of 1 part to 8 parts of water. Lower testing material should be used at increased strengths. The spraying should be done just before the bud swells, or preferably when the buds are swelling. This treatment is especially to be recommended, as it involves no extra application where it is necessary to spray during the dormant season for other insects, such as San José scale, oyster-shell scale, scurfy scale, blister mite, and the peach leaf-curl. In cases where it is not expedient to use the lime-sulphur solution, two early applications of arsenate of lead at the rate of 2 pounds to 50 U.S. (42 Impl.) gallons of water should be made. This should be applied first, when the buds are swelling, and again when the cluster-buds open. This latter application coincides with the first apple-scab treatment. In case of a bad infestation, it would be advisable to make another application of arsenate of lead when the buds are half open or bursting. It should be borne in mind that thorough control of this insect, by use of an arsenical, necessitates keeping the buds covered with poison as much as possible from the time they begin to swell until they are open.

DAVIDSON (W. M.). **Walnut Aphides in California.**—*U.S. Bur. Agric., Washington, D.C.*, Bull. no. 100, 31st August 1914, 48 pp., 18 figs., 4 pls. [Received 16th February 1915.]

The species of APHIDIDAE known to occur on walnut in California are *Chromaphis juglandicola*, Kalt. (the European walnut aphis), *Monellia caryae*, Monell (the American walnut aphis), *Monellia caryella*, Fitch (the little hickory aphis), and *Monellia californica*, Essig. The last species is the subject of brief mention only, while the others are fully described in all their stages and forms. *C. juglandicola* alone infests walnuts of commercial value in California, but latterly *M. caryae* and *M. caryella* have been found to be pests on native walnuts, much used for stock on which to graft the European or Persian nut. *C. juglandicola* probably occurs wherever the European walnut is grown. It is found sporadically on the underside of the leaves and on the young fruit of the European walnut, and its cultivated forms and hybrids. It appears on the upper surface of the leaf only at times of severe infestation. Badly infested nuts mature when only half grown and the attacks on the tree materially reduce its vitality. The sweet excretion of this aphid attracts large numbers of ants, *Formica subsericea*, Say, being the most abundant.

Monellia caryae, Monell, was first collected in Missouri in 1879. It occurs on the leaves of the walnut, hickory, and pecan, and has been reported from Illinois, Nebraska, Oregon and Michigan. It doubtless occurs in America wherever its food plants grow. The character and extent of its injury is similar to that of *C. juglandicola*. *Formica obscuriventris*, Mayr, is a very common attendant ant, and *F. subsericea*

is also associated with it. The insects attracted by its secretions include many flies of the families MUSCIDAE, ANTHOMYIIDAE, OSCINIDAE, and SYRPHIDAE, and many bees, besides POMPILIDAE, ICHNEUMONIDAE, BRACONIDAE and numerous smaller forms of insect life.

Monellia caryella cannot be distinguished from *M. caryae* except under a lens. In California, the normal food-plants of this species are *Juglans californica* (the California black walnut) and hybrids derived from this tree.

Walnut aphids have many natural enemies, all predatory, which reduce their numbers from June to September. Unfortunately, they do not appear in sufficient numbers until the nuts have been injured; artificial measures are therefore necessary. Should they appear in early spring they would quickly wipe out the few aphids then present and their progeny would starve to death. The commonest spider predaceous on walnut aphids is *Theridium placens*, Keyserling, but it is of little importance. Both mature and immature individuals of the small black Capsid, *Camptobrochis brevis*, Uhler, attack this pest, but they only appear in numbers in August and disappear in September. An Agromyzid, *Leucopis* sp., in its larval state preys upon the lice from June to August, but is never abundant enough to be of importance. The larvae of two Chrysopids, *Chrysopa majuscula*, Banks, and *C. californica*, Coq., are of economic value in California in this respect. The closely allied, but smaller Hemerobiid larvae are also predaceous. Next to the Coccinellids, Syrphid larvae are of greatest importance in control. The following Syrphids have been reared from larvae collected while feeding:—*Catabomba pyrastri*, L.; *Sphaerophoria melanosa*, Willist.; *S. sulphuripes*, Thoms.; *Allograpta obliqua*, Say, and *Eupeodes volucris*, O. S. *Syrphus opinator*, O. S., and probably other members of this genus, prey on the aphids. *Catabomba pyrastri* is the most abundant as well as the largest of these flies. Its aphidophagous capacity is almost double that of any of the other species enumerated. Its economic value is reduced by a parasite, *Bassus* sp., which often destroys as much as two-thirds of a brood. The following Coccinellids have been found feeding on these aphids:—*Olla abdominalis*, Say; *Adalia melanopleura*, Lec.; *Coccinella juliana*, Muls.; *Hippodamia convergens*, Guérin; *H. ambigua*, Lec.; *Coccinella californica*, Mann.; *Adalia bipunctata*, L.; *A. bipunctata* var. *humeralis*, Say; and *Chilocorus orbus*, Casey. The adults of the last-named occasionally attack the winter-eggs on the branches, while all the others, both in the larval and adult stages, feed on the aphids on the leaves. The first four are the most persistent enemies, the others only appearing spasmodically. Winter-spraying directed against the eggs is the easiest form of artificial control. Lime-sulphur and crude-oil emulsion are effective, especially the former. The spray should be directed all over the branches and twigs so as to cover every part. For spring or summer spraying a "combination of 2 per cent. distillate-oil emulsion and commercial tobacco extract No. 2 (1 to 1,500)" will prove effective. This tobacco extract contains 40 per cent. nicotine. The application must be made under a pressure of at least 150 pounds and it must be directed on the nuts and underside of the leaves. Details are given of the many experiments in winter and summer spraying from which the above conclusions are drawn. A bibliography of 22 works is given.

Quayle (H. J.). **Citrus fruit insects in the Mediterranean countries.**—*U.S. Dept. Agric. Washington, D.C.*, Bull. no. 134, 7th October 1914, 35 pp., 2 figs, 10 pls. [Received 16th February 1915.]

In Sicily, the author has reared *Ceratitis capitata*, Wied., (the Mediterranean fruit-fly) from the apple, azarole, fig, Indian fig, lemon, mandarin, nectarine, orange (sweet), orange (bitter), pear, plum and peach. The last-named fruit is the most severely infested. Several authorities have excluded the possibility of this fly breeding in lemons in Sicily, but the author has proved that this does occur, although infestation is very rare, as in Spain. The infested fruit were in such a decayed condition that they would have been useless for export. The larvae and adults of the Nitidulid beetle, *Carpophilus dimidiatus*, F., and the larvae of the fly, *Lonchaea splendida*, Lw., also occur in decayed oranges and lemons. *Saissetia oleae*, Bern., (the black scale) is generally distributed throughout the Mediterranean citrus regions, and in Valencia, which is the most important of them, it ranks first among citrus-fruit pests. Its chief natural enemy is the Chalcid, *Scutellista cyanea*, Mots. The Coccinellids, *Chilocorus bipustulatus*, L., and *Exochomus 4-pustulatus*, L., are the only other foes of importance, and they are general feeders. *Rhizobius ventralis*, Er., the most important Coccinellid on the black scale in California, was not seen in Spain or Italy. *Chrysomphalus dictyospermi*, Morg., occurs in Spain and Italy. Its natural enemies are the above COCCINELLIDAE and an *Aphelinus*, supposed to be *A. diaspidis*. *Lepidosaphes beckii*, Newm., has been considered a pest of little economic importance in Mediterranean countries, and this has been accounted for through the efficient work of parasites, but the author disagrees with this. Just as severe injury has been seen from this scale in Spain, as in California or Florida, and hitherto no internal parasite has apparently been recorded in Sicily. *Lepidosaphes gloverii*, Pack., (the long scale) seems limited to Spain, where it is particularly destructive in some districts. *Parlatoria zizyphus* is the commonest of all scales occurring on the lemon tree in Sicily and is also found in Spain. In Sicily, it is not extremely injurious to the tree, nor does it distort the fruit as does *Aspidiotus hederae*, Vall., which is found throughout Spain and Italy and is an important pest on ripe lemons in the latter country, being really of economic importance there in May and June. A species of *Aphelinus* is the commonest parasite of this scale in Italy: *Aspidiotiphagus citrinus* has also been reared from it. *Icerya purchasi*, Mask., (the cottony cushion scale) was observed in Sicily. It was not seen in Italy, except at Portici, and was not observed anywhere in Spain. A severe infestation in Sicily was so completely checked by *Novius cardinalis* that the latter disappeared for lack of food. *Cryptochaetum iceryae*, Will., an Agromyzid parasite, is the second most important enemy of this scale in some of the countries where it occurs, but it was not taken by the author in Sicily. *Pseudococcus citri*, Risso, (the citrus mealy bug) occurs in almost all citrus districts of Spain and Italy, and in 1913 it was the chief pest in Sicily, so much so, that the fallen fruit and leaves with the insects and cotton still on them gave the ground a distinctly whitish appearance. In Sicily, the natural enemies of *P. citri* include one Hemipteron, two Neuroptera, two Coleoptera, two Diptera, and six or seven Hymenoptera. The larva of the small moth, *Prays citri*, Millier, often does serious injury to the

blossoms of the orange and lemon. It is found in Sicily and in the Provinces of Calabria and Campania. The species of spider mite seen in all citrus-growing districts of Spain and Italy is identified by the Italian entomologists as *Tetranychus telarius*. What has been called *T. telarius* in the United States has recently been made synonymous with *T. bimaculatus*, Harv. [see this *Review*, Ser. A, iii, p. 63]. The author is of opinion that, judging from their difference in feeding habits, the *bimaculatus* of the United States and the European *telarius* are not synonymous, if the Mediterranean citrus species is properly identified as *telarius*. Another spider mite, probably a *Tenuipalpus*, was occasionally met with on citrus foliage in Sicily. The fruit of the orange is sometimes injured by a thrips, said to be *Heliothrips fasciatus*, Perg. With the exception of a little fumigation in Spain for the control of *C. dictyospermi*, and limited spraying in Italy for the same insect, practically no remedial measures are taken against citrus fruit insects in the countries bordering on the Mediterranean. Spanish growers state that in actual practice the cost of fumigation varies from about 1s. to 1s. 3d. per tree. In Sicily, the use of lime-sulphur advocated by Savastano is becoming popular for the control of *C. dictyospermi*. Dr. G. Brigante states that *Prays citri* may be controlled by a 1 per cent. solution of lead arsenate. Poison sprays are, however, in bad repute in Italy. Of the citrus insects discussed above, two do not occur in the United States, namely, *C. capitata* and *Prays citri*. Two others, *C. dictyospermi* and *P. zizyphus*, occur, but do not appear to be important pests, as is the case in the Mediterranean region. The two former insects could be controlled in the United States by the methods now in use there. This fact, however, should not prevent quarantine measures being taken against them. A brief survey of the Mediterranean citrus fruit industry concludes this paper.

FLETCHER (T. Bainbrigge). **Report of the Imperial Entomologist.**—*Rept. Agric. Research Inst. & Coll., Pusa 1913–14, Calcutta*, 1914, pp. 62–75. [Received 12th February 1915.]

In Bombay, special attention has been paid to the control of *Schoenobius bipunctifer*, which moth is a serious pest of rice. In the Central Provinces, large numbers of *Canthecona furcellata*, a Pentatomid bug predaceous on caterpillars, were bred and liberated in cotton and gram fields to check attacks on these crops. In the United Provinces, demonstration was made in the Farrukhabad District of methods of storing seed potatoes to avoid attack of *Phthorimaea operculella* (the potato moth), which is now widely distributed there, though as yet it has apparently not reached the Hill Districts. In the Punjab, the work done was mainly on pests of cotton and stored grain, and living specimens of *Rhogas lefroyi*, a Braconid parasite of the cotton bollworm (*Earias*), have been supplied from time to time from Pusa. The sugar-cane crop in the North-West Frontier Province was badly infested with borers, over 50,000 egg-clusters having been picked from one experimental plot of six acres. *Gelechia gossypiella* did considerable damage to the cotton crop, late-ripening varieties being attacked most severely, while local cotton, *Gossypium neglectum*, which ripens and is picked before mid-October, practically

escaped attack. Living specimens of *Rhogas lefroyi* were released in the cotton fields at Tarnab, but it is doubtful whether they have established themselves. A Jassid bug, attacking grape-vines in the vineyards in the lower parts of the Peshawar Valley, has also been under investigation. The most important work undertaken in Bihar was the control of *Agrotis ypsilon* on the Mokameh Tal and the storage of potatoes. At Mokameh, during the season, 39,000 caterpillars were picked and destroyed on the high lands, whilst 34 traps destroyed 893,320 moths, of which about 41 per cent. were females. On account of abnormal flood conditions and other factors, the attack was unusually serious, about 1,652 acres of ragi pulse crops being destroyed. A similar campaign was undertaken against the same insect for the first time, at Colgong and Ghogha, where 21 traps destroyed 43,874 moths, while 337,600 caterpillars were handpicked from the high lands which were first attacked ; the attack, which normally extends over an area of about 2,644 acres, was reduced to a nominal damage over 6 or 7 acres as a result of these efforts. As in other provinces, the storage of seed potatoes has of late years presented great difficulties in Bihar, owing to the introduction of *P. operculella* into India. Storage under dry sand has proved fairly effective in the districts south of the Ganges, and Government store-houses were started at various places in order to demonstrate the practicability and advantages of this method, which is now being more widely adopted. Another pest of stored potatoes in Tirhut is a Tingidid bug, *Recaredus* sp., and experiments are being made to find a successful method of control, as sand-storage is found to induce rotting of the potatoes in the damp climate of Tirhut.

In the life-history investigations at Pusa, complete life-cycles were obtained of the following insects : The Fulgorid, *Pyrilla aberrans* ; *Aleurodes bergi*, *A. citri* ; the Acridian, *Atractomorpha crenulata* ; the weevil, *Odoiporus longicollis* ; the bugs, *Dolycoris indicus*, *Harpactor costalis* and *Canthecona furcellata* ; the moths, *Eublemma olivacea*, *Amata* (*Syntomis*) *cyssea*, *Taragama siva* and *Papua depressella*, Swinh. (*Polyocha saccharella*) ; the butterfly, *Virachola isocratis* ; a Psocid on *Loranthus* ; and an unidentified Dermestid beetle on stored wheat ; other pests of stored grain, the life-histories of which have been worked out are the Dermestid, *Aethriostoma undulata*, *Tribolium castaneum* (*ferrugineum*), and *Rhizopertha dominica*.

Information on the subject of natural enemies of crop-pests is being collected and special attention has been paid to the parasites and hyperparasites of *Earias* spp., *Achaea janata*, L., (*melicerta*, Drury), and *Pieris brassicae*. An attempt is being made to procure a parasitised colony of *Aleurodes citri* for export to Florida, where this pest has done vast damage to the orange industry, and an apparently identical parasite has also been reared from *A. ricini*, which occurs commonly on castor in India ; specimens of the two parasites have been sent to Washington for determination, as their identity, if established, will be of practical importance.

Attempts have been made to trace *Agrotis ypsilon* through the hot weather and rains, as it is not known in what stage the insect passes this period on the Mokameh Tal. Incidentally, in collecting the larvae, it was found that they are preyed upon extensively by the Carabid, *Broscus punctatus*.

Work on termites has been continued, and wood treated by various processes was examined in February 1914 ; some pieces of Powellized wood were found to be attacked by *Microtermes obesi* (*anandi*), and this process is therefore not so infallible as has been claimed. Further examinations indicated that exemption from attack depends on the variety of the wood itself, as well as on the method of treatment, and the preferential tastes of the various species of termites locally prevalent. A further series of experiments is being initiated.

Coccus (*Lecanium*) *viridis* (the green scale), a serious coffee pest in Ceylon and Southern India, invaded Coorg in 1913 [see this *Review*, Ser. A, ii, p. 578], where it seems likely to become a pest ; the scale was found to be parasitised to a very slight extent by a minute undetermined Chalcidid, apparently *Coccophagus* sp.

A consignment of *Microsporidium polyhedricum* in dead silkworms was received from Egypt, where this organism is said to be effective in the control of *Prodenia litura* [see this *Review*, Ser. A, ii, p. 105], but experiments at Pusa gave negative results with silkworms and larvae of *P. litura.*

Fletcher (T. Bainbrigge). **Some South Indian Insects. Madras : Govt. Press, 1914, xxii + 565 pp., 50 pls., 440 figs. Price 9*s*.**

The author says in his preface that the insect-fauna of Southern India is probably less known than that of the Himalayan region and that it is only within the past 14 or 15 years that the study of the entomology of this region has been undertaken on scientific lines. This large book is the result of an examination of the collections at Madras with a view to leaving them in order before the author's departure to take up his appointment as Imperial Entomologist at Pusa and it is pointed out that the list of crop-pests, despite the fact that 521 insects are dealt with, is not complete, nor is it likely that this can be the case for many years. Nine chapters are occupied by a general description of insects, classification and nomenclature, metamorphosis, means of defence and communication, tropisms, relations to plants, symbiosis and parasitism, etc. Other chapters deal with insects as pests and their control, and an account of the various methods of dealing with them in general use.

The pests themselves are then dealt with under various heads, including pests of stored products, insects and disease, beneficial and useful insects, with a chapter on some other animals and birds useful or otherwise. An important section of the book is a list of crops with the insect pests of each, with a page reference to the description of the insect concerned. The remainder of the book is devoted to a description of the individual insects in systematic order. Of the 50 coloured plates, the author says that they have been reproduced from original drawings made at the Agricultural Research Institute at Pusa and have most of them been previously published. They are of variable quality and the author apologises for the text-figures, most of which are original and illustrate insects which have never been figured before, as they have been prepared by artists who had no previous experience in making drawings of insects for purposes of reproduction. Despite these defects, the book forms a very useful work of reference, and is well worth the low price charged for it.

TRÄGÅRDH (I.). **Skogsentomologiska bidrag 1–5.** [Forest entomological contributions 1–5.]—*Entomologisk Tidskrift, Stockholm*, nos. 3–4, December 1914, pp. 188–209, 12 figs.

The Chalcidid, *Ageniaspis fuscicollis*, Dalm., was found in the larvae of two needle-mining Microlepidoptera, *Ocnerostoma piniariella*, Zell., and *Dyscedestis farinatella*, Dup., in the neighbourhood of Stockholm. This species which has a polyembryonic development, described by Bugnion, Marchal and Silvestri, has been previously recorded from *Hyponomeuta cognatellus*, *H. malinellus* and *Prays oleellus*.

In some cases, in 1913, as many as 75 per cent. of the needle-miners were parasitised, and, as might have been expected, in the autumn of 1914 it was very difficult to find any. It is suggested that this parasite, owing to its polyembryonic development and to some extent polyphagous habits, might with advantage be made use of against injurious forms of Microlepidoptera.

The Anthocorid, *Peozostethus cursitans*, Fall., which occurs commonly in the burrows of bark-beetles in the vicinity of Stockholm was found by the author to feed on their larvae.

The larva of the Dolichopid, *Medeterus signaticornis*, Lw., which occurred in the same localities and was found regularly with the bark-beetles also feeds on the larvae and pupae, and as it is a common insect, its importance may hitherto have been underestimated. Agromyzid cambium-miners in birch trees have not been previously recorded from Sweden, whereas in Germany, Denmark and the U.S.A. they have occurred repeatedly. They were observed last summer in Bjurfors, where young birch trees were attacked to such an extent that the timber was useless for other purposes than fuel. The larva of an *Agrilus*, believed to be that of *A. betuleti*, F., was found in the cambium of a birch tree under circumstances which render it very probable that it causes marks in the wood similar to those produced by the larvae of *Agromyza*.

VASSILIEV (E. M.). **Вліяніе шведской мушки на ростъ и урожай яровыхъ злаковъ.** [The influence of *Oscinis frit*, L., on the growth and yield of summer-sown cereals.] (From the Experimental Entomological Station of the All-Russian Society of Sugar-Refiners in Smiela, govt. of Kiev.) Reprint from **«Южно-Русская Сельско-Хозяйственная Газета.»** [*South-Russian Agricultural Gazette*], *Charkov*, 1914, 17 pp.

Observations on *Oscinis frit* conducted in 1911 in the government of Petrograd are described, the object of which was to prove that the application of mineral manure practically nullifies the damage by this pest. The deductions are based on observations on the effects of *Chlorops taeniopus*, Meig., on barley, of *Cecidomyia destructor*, Say, on rye, and of *Oscinis frit* on oats. Barley injured by *Chlorops taeniopus* produced no grain at all on plots without manure, but on plots manured with phosphates, the plants were able to produce normal-sized grain, although the yield was less. The effect on rye was less visible, though the plants on unmanured plots were more easily broken by the attacks of the Hessian fly, than on plots manured with basic slag. Experiments on the effect of *Oscinis frit* on oats

are more fully described. The results are shown in several tables, and it appears that the soil of the government of Petrograd, consisting of clay on which the forests have been burned, is poor in phosphorus and nitrogen. The percentage of infected plants on all plots was 38 ; that of plants which perished altogether on unmanured plots was 21, and on plots manured with phosphorus and nitrogen 5½ ; the percentage of plants which were not able to produce normal grain was 48½ on the unmanured plots ; on those manured with phosphorus and on those manured with phosphorus and saltpetre, 16. The addition of potash led in one case to a further improvement of 6 per cent. From these figures, it is concluded that under the optimum conditions for the crops *O. frit* has no marked economic influence, when the infection is not greater than 40 per cent. Oats damaged by *O. frit* and manured with saltpetre, tiller well and produce new shoots which ripen at the normal time. The author disputes the statement by Kurdjumov and Andreeva in the paper read by them at the Entomological Conference in Kiev in August 1913 [see this *Review*, Ser. A, i, pp. 497–498] that *O. frit* is harmless to summer-sown crops, if sown at the proper time, and that in some cases its influence, compared by the authors to that of " a gardener who pinches the shoots and thus directs the sap to the formation of fruit," is even beneficial ; in his opinion *O. frit* is undoubtedly a pest, although in some cases, as stated above, its effects can be largely annulled. It would be more correct to compare its influence to that of a " market gardener who pinches the central shoot of a plant in order to provoke tillering."

KASSATKIN (A. N.). **Култура лука и хрѣна въ г. Суздалѣ и слободѣ Мстерѣ, Владимiрской губ.** [The cultivation of onions and horse-radish in the town of Suzdal and the village of Mster of the govt. of Vladimir.]—**« Садъ и Огородъ.»** [*Orchard and Market-Garden.*] *Moscow*, nos. 6 and 12 ; June and December 1914 ; pp. 287–290 and 470–477.

Hylemyia antiqua, Mg., destroys yearly from 20 to 25 per cent. of the harvest of onions in Suzdal. Rotation of crops and the poisoning of the soil with formalin are the remedies usually recommended, but the author suggests also spraying with carbolic acid emulsion and with a mixture of carbolic acid and lime, and points out the necessity for further studies on the biology of this pest under the local conditions. Horse-radish is damaged by various Chrysomelid beetles, both adults and larvae of which devour the leaves.

SHTCHERBAKOV (Th.). **Новый вредитель кукурузы.** [A new pest of maize.]—**« Южно-Русская Сельско-Хозяйственная Газета.»** [*South-Russian Agricultural Gazette*], *Charkov*, no. 46, 17th December 1914, pp. 8–9.

This article recapitulates the injuries caused to maize by *Oscinis* (*Oscinella*) *frit*, L., [see this *Review*, Ser. A, iii, p. 98]. The paper on this pest by Kurdjumov and Andreeva, read at the Entomological Conference at Kiev, in August 1913 [see this *Review*, Ser. A, i, pp. 497–498], and the work of E. M. Vassiliev are referred to, and it is pointed out that the last-named author could only dispute the statement

of the other two if the observations of all of them were conducted on the same method, which is not the case. At the same time the author agrees with Vassiliev that it is impossible to accept the conclusions of Kurdjumov and Andreeva, and thinks that, so far as maize is concerned, the influence of *O. frit* is more adequately expressed by Vassiliev, but does not accept his conclusions as correct for every case.

DU PORTE (E. M.). **The Wavy-striped Flea-beetle (*Phyllotreta sinuata*, Steph.).**—*Canadian Entomologist, London, Ont.*, xlvi, no. 12, December 1914, pp. 433–435, 3 figs.

Although *Phyllotreta sinuata* is widely distributed throughout Europe and many parts of the United States, it was not noted as a pest in Canada until June 1913, when the larvae were observed mining in the leaves of cress and feeding on the foliage of radish [see this *Review*, Ser. A, ii, p. 664]. The insect was again present in Quebec in 1914, feeding on radish, turnips, and cabbage. This species is often associated with *P. vittata*, F., and it is probably owing to its close resemblence to it, that it has escaped detection. A description of the larva, pupa and adult of *P. sinuata* is given, and the chief points of difference between it and *P. vittata* are recorded.

MARCOVITCH (S.). **A species of *Megastigmus* reared from larch seeds.**—*Canadian Entomologist, London, Ont.* xlvi, no. 12, December 1914, pp. 435–438, 1 plate.

The Chalcidid, *Megastigmus laricis*, sp. n., is described from adults which emerged on 2nd April 1914, from seeds of larch trees at Ithaca, New York. The larva completely devours the kernel, and fills the entire seed.

JONES (B. J.). **The Natural Modes of Distribution of Pear Blight in California.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iii, no. 12, December 1914, pp. 505–511, 2 figs.

The great mass of evidence gathered during a year's work in a study of the agencies responsible for pear blight distribution was directly incriminating to the insects found in the pear orchards. Inasmuch as the mode of carriage is mechanical, almost any insect capable of moving from one tree to another may act as a carrier of infection. The winter stages of the disease are the foci of infection, and their complete eradication, though accomplished in individual cases, cannot be effected universally. The summer infection begins with the rise of the sap and continues as long as there is any vegetative growth in the tree, and it is in this season that the damage done by insects is greatest. The blight enters, through the late bloom, the lateral and terminal buds of growing shoots and the fruits. The greatest loss has been that which occurred through blighted shoots at the base of the trees, and these, though useful in protecting the boles, if they became blighted, generally involve the destruction of the tree. Bees, house-flies, ants, thrips and other insects all tend to distribute the disease, and on or beneath the ground it is carried by Elaterid and other beetles. The disease requires 4 to 6 days after

inoculation before it becomes evident, and the only remedy appears to be constant watchfulness and the immediate removal of all attacked parts ; careful examination is necessary, as twigs often show the blight exudation before they wither sufficiently to attract attention.

HECKE (G. H.). **Winter Work in a Prune Orchard.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* iii, no. 12, December 1914, p. 533.

A sixty acre prune orchard, 23 years old, near Sacramento, was first infested with the European fruit scale [*Aspidiotus ostreaeformis*] in 1907, when, except for the liberal introduction of *Comys fusca,* no control measures were adopted, and in 1908–09 this parasite was proved a total failure. A partial control for the scale was begun in 1910 with a distillate spray, but as the years 1911–12 again showed a rapid increase of the pest, a campaign was decided upon in the autumn of 1913, spraying operations being commenced in December, which, owing to heavy rains, were not finished until 1st March 1914. Several kinds of sprays were used, but the best results were given by crude oil emulsion, used at the rate of 32 gallons of oil emulsion for the 200-gallon tank. The average amount per tree used was 11 gallons, this large quantity resulting in the practical extermination of the scale.

SMITH (H. S.). **The progress of** *Scymnus bipunctatus.*—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* iii, no. 12, December 1914, p. 535, 1 fig.

Scymnus bipunctatus, Kugel., a Coccinellid predaceous upon *Pseudococcus citri* (the citrus mealy bug), was obtained in the Philippines by the author in the autumn of 1913, and in June 1914, a colony of several thousand adults were sent to Alhambra, Cal., for liberation. It is believed that this ladybird is the same as that introduced by G. Compere as *Cryptogonus orbiculus* in 1910, but which apparently did not become established. A visit to the site of the June colony showed this species to be breeding by the thousand upon the lemon trees where they had been liberated. As it is a tropical insect, the crucial test of its ability to establish itself in California will occur during the winter months. If it does so, it should become of considerable value in the control of *P. citri.*

Insect Notes.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* iii, no. 12, December 1914, p. 539.

Eulecanium robiniarium, Dougl., and a Cercopid are reported to be common on madrone, and *Rhizoglyphus hyacinthi* (the common bulb mite) has been taken on onions. Adults of *Hippodamia convergens,* Guér., were collected in their hibernating quarters in the Feather River Canyon in large numbers on November 15th. *Orcus chalybeus* (the steel-blue ladybird) was observed feeding upon *Saissetia oleae* (the black scale) ; *Chionaspis quercus,* Comst., has been taken on *Quercus lobata ; Cydia pomonella,* L., has been infesting English walnut to a rather unusual extent during the past season ; *Phytomyza aquifolii,* Gour., was intercepted in the first shipment of holly from

Holland in 1914; *Pseudococcus aurilanatus*, Mask. (golden mealy bug) has been seriously damaging Araucarias; *P. citri* is reported as breeding in considerable abundance on a carob tree, and *Apion cubicolle* as feeding on olives. Adults of *Scudderia furcifera* and *Schistocerca* sp., were common on 10th November, in the Feather River Canyon.

GAHAN (A. B.). U.S. Bur. Entom. **Description of New Genera and Species, with Notes on Parasitic Hymenoptera.**—*Proc. U.S. Nat. Mus., Washington, D.C.*, xlviii, 16th December 1914, pp. 155–168.

In this paper, descriptions of the following parasitic Hymenoptera are given:—*Hyposoter interjectus* (OPHIONINAE) on *Prodenia ornithogalli*, Mississippi and Florida; *Nepeira benevola* (OPHIONINAE) on *Eurymus eurytheme*, Utah; and *Aphaereta sarcophagae* (ALYSIINAE) on *Sarcophaga kellyi*, Kansas.

Liodontomerus perplexus, gen. et. sp. n. (MONODONTOMERINAE) and *Trimeromicrus maculatus*, gen. et. sp. n. (PTEROMALINAE) both from lucerne seed-pods infested with *Bruchophagus funebris*, Arizona; *Anastatus semiflavidus* (EUPELMINAE) from eggs of *Hemileuca oliviae*, New Mexico; *Eupteromalus sarcophagae* (PTEROMALINAE) on *S. kellyi*, Kansas; *Habrocytus medicaginis* (PTEROMALINAE) from lucerne seed-pods infested with *B. funebris*, California; *Euplectrus insuetus* (ELACHERTINAE) on *Lorema accius*, Florida; *Diaulinus insularis* (EULOPHINAE) on *Agromyza inaequalis*, Porto Rico; *Ceratoneura pretiosa* (TETRASTICHINAE) reared from galls on *Mimosa*, Texas; *Tetrastichus euplectri* (TETRASTICHINAE) from *Euplectrus platyhypenae*, Louisiana; and *T. venustus* from lucerne seed-pods infested with *B. funebris*, California.

NOVELLI (N.). **Lotta contro la grillotalpa nelle regioni risicole.** [Mole-cricket control in rice-growing districts.]—*Giorn. Risicoltura, Vercelli*, iv, no. 13, 15th July 1914, pp. 189–193. [Received 2nd March 1915.]

Gryllotalpa gryllotalpa (*vulgaris*) is spreading to a great extent in the abundantly watered rice-growing districts in Italy, owing to favourable conditions and the lack of control. On ground previously planted with rice, wheat, oats, rye and maize have been severely attacked, the maize having sometimes to be resown. If rice is sown in dry soil, it may also suffer in the same manner, and during the periods when the water is let out from the rice-fields, the insects come down from the banks and injure the growing rice, the banks themselves being mined by their galleries. Ploughing is usually carried out in spring and autumn, whereas summer ploughing would aid control by interfering with breeding. The plough should be followed by workers on the look-out for nests, which should be destroyed. The mole-crickets also infest rice-fields laid down to grass, which, when afterwards sown with wheat or maize, help to spread infestation; frequent ploughing of such lands before sowing is advisable. When water is admitted into the fields, the mole-crickets abandon the submerged portions and may be killed while retreating. The banks should be dug over and the nests destroyed. Carbon bisulphide

may also be injected into the banks, holes 8 inches deep being drilled at intervals of 32 inches. An inspection of the banks half an hour later will enable any individuals which have escaped to the surface to be seen and destroyed. Watering the banks with an emulsion containing 20 per cent. of petroleum in water will also drive them out.

HUNTER (W. D.). **The Pink Bollworm.**—*U. S. Dept. Agric., Bur. Entom. Washington, D.C.*, 7th August 1914, 6 pp., 5 figs.

This circular (without a serial number) gives information about *Gelechia gossypiella*, Saund., the introduction of which into the United States is to be guarded against.

LAKIN (G. I.). **Обзоръ огородничества въ Астраханской губерніи за 1913 годъ.** [A Review of Market-Gardening in the govt. of Astrachan in 1913.]—**«Садъ и Огородъ.»** [*Orchard and Market-Garden*], *Moscow*, nos. 9 and 10, September and October 1914, pp. 338–346 and 383–388.

Market-gardens in 1913, in the government of Astrachan, suffered largely from the caterpillars of *Euxoa segetum*, which were specially injurious to bachza plants, such as melons, etc. On melon plantations, the pest can be successfully controlled by hand collection at night and by spraying with Paris green. Melon seedlings can stand as much as $\frac{1}{2}$ oz. of green to the gallon of water.

DJAKOV (I.). **Смертность пчелъ въ связи съ болѣзнью « Нозематозъ» .** [The death of bees from "Nosematosis"]. **«Сибирское Сельское Хозяйство.»** [*Agriculture of Siberia,*] *Tomsk*, no. 23, December 1914, pp. 743–746.

A serious outbreak of nosematosis has occurred among bees in the government of Tomsk during the last three years, causing great havoc in many localities. The disease, which was identified in the laboratory of the Department of Agriculture, manifested itself chiefly in the winter and spring.

PLATONOV (A.). **Изъ дѣятельности Ефремовскаго Уѣзднаго Земства по садоводству въ 1913 г.** [The work of the Zemstvo of the district of Efremov (govt. of Tula) on Horticulture in 1913]. **«Садъ и Огородъ.»** [*Orchard and Market-Garden*], *Moscow*, no. 7–8, July-August, pp. 316–319.

The chief pests of the district were *Psylla mali* and *Cydia* (*Carpocapsa*) *pomonella*. Spraying with tobacco extract and with a solution of quassia and soft soap was tried against the larvae of *Psylla* and in May and June the control of the imagines was attempted by fumigation with tobacco smoke, which gave excellent results. Spraying with Paris green was used against *C. pomonella*. The older orchards of the district are very closely planted, thus offering favourable conditions for various pests, which in some cases destroy as much as 60 per cent. of the yield.

NOTICES

The Editor will be glad to receive prompt information as to the appearance of new pests, or of known pests in districts which have hitherto been free from them, and will welcome any suggestion the adoption of which would increase the usefulness of the Review.

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Bureau, are requested to communicate with the Assistant Editor, 27, Elvaston Place, Queen's Gate, London, S.W.

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SERIES A: AGRICULTURAL.

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Wildermuth (V. L.). The alfalfa caterpillar.—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 124, 28th August 1914, 40 pp., 20 figs., 2 pls. [Received 16th February 1915.]

It is only since 1910, that *Colias* (*Eurymus*) *eurytheme*, Boisd., (the alfalfa butterfly) has been known as a serious pest. It occurs throughout the United States and is now one of the worst enemies of lucerne, causing an annual loss of from £100,000 to £200,000 in Arizona and California alone. The complete life-cycle of *C. eurytheme* averages about 38 days for all generations, the minimum being about 26 days for the third brood and the maximum 64 days for the first. The annual number of generations varies from two in cold districts to six in warm ones. Males usually complete the developmental period several days sooner than the females. Lucerne seems to be the favourite food-plant, but *Trifolium reflexum*, and *T. stoloniferum* (buffalo clovers) were probably the original native ones. It also feeds on *T. pratense* (red clover), *T. hybridum* (Alsike clover), *Glycine hispida* (soya bean), *Pisum sativum* (Canadian field pea), and *Vicia sativa* (hairy vetch), and other plants. Attempts to rear the larvae from *Vigna sinensis* (cowpea) failed. In Texas, the larvae aestivate during the dry period in summer when the food supply has become exhausted, but this has never been recorded in the south-west, and the change in habit is probably due to recent irrigation, as the lucerne fields of this once arid country enable it to remain active throughout the summer and to become the pest that it now is. It would be a much more serious one but for its numerous natural enemies. Of 154 pupae collected in Arizona on 26th August 1912, 82 were infested by Chalcid parasites; 37 destroyed by intestinal disease; 28 partially eaten by *Chloridea obsoleta*, etc.; 6 infested by Tachinid parasites; and only one was alive and healthy. The percentage of parasitism usually reaches its maximum in August, so that much damage is seldom done by the caterpillars after that date. The very common *Trichogramma minutum*, Riley, seems to be the only egg-parasite. Larval parasites include an Ichneumonid, *Limnerium* sp. n., *Apanteles* (*Protopanteles*) *flaviconchae*, Riley, and *Chalcis ovata*, Say. The recently described *Pteromalus eurymi*, Gahan, is of great assistance in checking this pest and 49 per cent. of the pupae collected by the author in August 1912 were parasitised by this species. *P. eurymi* seems to be distributed over a considerable area, being present in Arizona, California, Utah, Kansas and Tennessee. It seems almost certain that this parasite winters as a larva within the pupal shell of the host. The combined length of the egg, larval, and pupal stages in the warmer weather of August is from 12 to 15 days, while the pupal stage was found to cover 4 days in the month of August, and 12 to 15 days in February. *Phorocera claripennis*, Macq., is the most important of three Tachinid parasites, the others being *Frontina archippivora*, Will., and *Masicera* sp. A Phorid, *Aphiochaeta perdita*, has been reared several times from pupae which were alive when collected, and it could not have been acting as a scavenger, but must have been a true parasite. *Chloridea* (*Heliothis*) *obsoleta* (the common bollworm) is often mistaken for *Colias eurytheme* by the farmers. It was found to do little injury to lucerne, but to be a ravenous enemy of the caterpillars of this butterfly, never eating the former so long as it could find the larvae or pupae of the pest. The Melyrid beetle, *Collops vittatus*, Say, feeds

upon the pupae ; the ants, *Pogonomyrmex barbatus*, Smith, and *Cremastogaster lineolata laeviuscula* var. *clara*, Mayr, kill the larvae ; and several species of ASILIDAE eat the adults, including *Proctacanthus milbertii*, Macq., and *Stenopogon picticornis*, Lw. A fungus which attacked the pupae in the Salt River Valley in 1912, is stated to be probably an undescribed parasitic *Fusarium*, and is by far the greatest natural check on this pest. The disease is endemic, but only becomes prevalent when high humidity and warm weather occur together. It is therefore artificially increased by irrigation, and using fields for pasture has somewhat the same effect. Systematically and carefully pastured fields suffer the minimum of injury. Cattle should never be allowed on a field when wet, nor for too long a period, say from 24 to 35 days, and disking or renovating should always follow so as to loosen the soil. If fields are closely and cleanly cut there will be no food to enable any remaining caterpillars to complete their development, and they will not be protected from an early irrigation or from the rays of the sun. Early cutting is a valuable help in control, and by disking or renovating every winter and in the month of August, or oftener if possible, any pupae present will be disturbed. A field should never be abandoned because the caterpillars threaten the destruction of a crop before it can mature. It should be mowed at once, cutting it low and clean. A part of the crop will thus be saved and a great many generations of the pest will be starved and killed by exposure to the sun. Disking, followed by rolling or brush-dragging, will kill the majority of the remaining larvae. The ground should then be thoroughly irrigated.

STEBBING (E. P.). **Indian Forest insects of Economic Importance: Coleoptera.** London: Eyre & Spottiswoode, Ltd., 1914, xvi+648 pp. 54 pls., 401 figs.

The study of Indian forest insects is said by the author to be still only in the pioneer stage, but the mass of material available was so great that it was considered advisable to confine this volume to the Coleoptera. The area dealt with includes India, Burma and Ceylon. The first chapter of the book deals with the distribution of the insect fauna of the Indian forests, and it is shown that the attempt to divide the forest area into regions more or less according to climate or by their prevailing trees as a basis for the study of insect fauna, breaks down, as both trees and insects pass the artificial boundaries and the latter accomodate themselves to new hosts. The distribution of the Sál longicorn, *Hoplocerambyx spinicornis*, is a good example. The beetle attacks this tree both in the Central Provinces and Assam, but in the Shan Hills, far beyond the distribution limit of the Sál, it attacks *Duabanga sonnatioides* and *Pentacme suavis*, while northwards the Sál extends to the foothills of the Northern Himalayas, but the beetle does not follow it, its place being taken by another longicorn, *Aeolesthes holosericea*. The second chapter reviews injurious insects from the point of view of the part attacked and the means at the disposal of the insect for effecting the damage, and beneficial insects, predatory and parasitic, are noticed. The next chapter deals with methods for ascertaining the presence of insect pests and the study of their life-histories. The chance capture near

a forest of an insect capable of injuring trees, if properly followed up, may lead to valuable discoveries, as, if the insects are about, they are probably ovipositing, and the egg stage in the case of the more dangerous wood and bark-boring beetles is often very short, forty-eight to sixty hours or even less. The contributory aids to the spread of insect forest pests are discussed; for example, the question of pure or mixed woods, the former, if attacked at all, naturally providing more of the special host tree required in a given area and thus encouraging the spread of the pest; the proper conduct of felling operations and the rapid removal of the timber; the effect of forest fires and natural causes of injury, such as windfalls, snow-break, frost, etc., the damage begun by these being only too often completed by insects. The methods of preventing attack or combating an attack in progress are then dealt with. Examples are given of the various ways in which insect damage takes place, with the suitable remedies; in many cases these are necessarily very drastic. A brief description of the general characters and classification of the Coleoptera is given, and the author then proceeds to deal with individual insects in order, giving under each, the habitat, the trees attacked, when known, and a concise life-history, in those cases in which it can be given, and descriptions of parasites. A very large proportion of the insects dealt with are figured, and the index contains nearly 850 names. There is also a special index of trees. The plates, particularly those illustrating the nature of damage done by the insect, are excellent, and the book contains a large amount of valuable practical information.

Smith (L. B.). **Pea aphis control experiments: Preliminary Report for 1914.**—*Virginia Truck Expt. Sta., Norfolk*, Bull. no. 13, 1st October 1914, 12 pp. [Received 2nd March 1915.]

Macrosiphum pisi, Kalt., is one of the most destructive pests with which truck-growers in Tidewater, Virginia, have to contend. The present report embodies the results so far attained from experiments begun in the spring of 1914. A combination of whale-oil soap, 4 lb., and Black-leaf 40, 10 oz., to 50 U.S. gals. (41·6 Impl.) of water, gave the best and most satisfactory spray. In no case did it injure the plants and 98 per cent. of the aphids were killed on the one-half acre plot where it was used, which gave a good crop. The aphids are apparently more susceptible to this combination than when the insecticides are applied separately, even if, in the latter case, larger quantities are used. In order to determine the effect of sprays upon the aphids at different stages of their development, plots were sprayed with the three most promising formulae, and the one given above again demonstrated its great superiority, for it killed 95·4 per cent. of the adults, 93·9 of half-grown individuals, and 98·6 per cent. of the young. Whale-oil or fish-oil soap may be bought or made at home. The home-made soap contains no free potash and is therefore less likely to injure the foliage. In commercial soap the water content is variable, while in the home-made article, this is not the case. The following formula for potash fish-oil soap has had some success:—Caustic soda, 1½ lb.; water, 1½ U.S. quarts; fish oil (warmed), 6 lb. After dissolving the soda in the water, the oil is added very slowly with very thorough

stirring. The soap mixture should be allowed to stand 24 hours before use. The above formula will make about 8 lb. of soap. In the experiments mentioned in this paper, the commercial soap used was "Caustic potash fish-oil soap No. 3." A table gives the cost of 50 U.S. gallons (41·6 Impl.) of nicotine solution at the then current price, for strengths varying from 1 : 457 to 1 : 3,000. Both the soap and the nicotine should be diluted before mixing together, otherwise a white precipitate is formed which clogs the nozzles. An alternative formula is made up of whale-oil soap, 5lb., in 50 U.S. gallons (41·6 Impl.). Spraying should begin as soon as the Aphids have migrated from the clover or other plants to peas. One of the difficulties in spraying is to reach the individuals which have crawled in between the terminal leaves, and as the first generation or two on the spring peas rarely feed in these places, early spraying is the most effective. On a bright, clear day the liquid dries more readily and is less likely to injure the plants. For spraying peas, a two-wheeled cart, carrying a 50-gallon tank and a good pump able to maintain 120 to 150 pounds pressure, with at least nine nozzles, is probably the best. The wheels must have moderately wide tyres and should be adjustable to suit the rows. The pump should be run by adjustment to the axle. The pump used in the experiments was able to develop 250 pounds pressure when in good condition. The "Mistry Jr." and the "Simplex" nozzles gave satisfaction, the spray being coarse enough to drive open the terminal leaves and flower-clusters and yet fine enough not to gather in large drops. The type of sprayer is illustrated : there are three nozzles to each row ; one vertical, shooting a spray directly down on the row, and two lateral, which throw a spray towards each side of the row. The latter nozzles are placed at an angle slightly above the horizontal plane, so that the spray will strike the under sides of the leaves. Using an ordinary traction sprayer, not more than three rows can be dealt with at once, as the pressure will be insufficient for satisfactory results. Based on the whale-oil soap and Black-leaf 40 formula and on a machine which will spray twelve acres per day, using six nozzles, and covering two rows at the same time, the average cost of one application at the rate of 75 U.S. gallons ($62\frac{1}{2}$ Impl.) is about 11s. 8d. per acre. If 100 U.S. gallons (83 Impl.) be used, this figure amounts to 15s. 1d. With the alternative formula, the costs for one application are 3s. 11d. and 4s. 11d. respectively. Johnson (*U.S. Bur. Entom.*, Bull., no. 26, N.S., p. 57) has recommended the following method of control : On a day when the sun is hot, with the thermometer above 90° F., the pea aphids may be killed by knocking them off the plants with a pine branch, following immediately between the rows with a cultivator. This covers the insects with an inch or so of hot earth, having a temperature of 115–119° F., which is fatal to them. Even if the soil is not hot enough to kill them at once, they will usually all be destroyed within 48 hours. This process should be repeated every third day for a fortnight. In Virginia, this method has had some success where peas are planted alone, but when planted with another crop it is almost useless. Clover, especially crimson clover, should not be planted near peas, but if it is necessary to do so, the peas should be carefully examined every day and as soon as aphids are noticed control must be effected. Highly fertile land will help the crop to mature in spite of the attacks of aphids. Early varieties are less liable to be seriously injured.

RUTHERFORD (A.). **Some Insect Pests of 1913.**—*Ceylon Dept. Agric., Peradeniya*, Bull. no. 15, December 1914, 8 pp.

This bulletin is an extract from the Government Entomologist's report for 1913 [see this *Review*, Ser. A., ii, p. 643]. Included in the present paper are the following insects, which were not identified in time for publication in the report: The moths, *Brachycyttarus subteralbatus*, Hmp., and *Homona coffearia*, Nietn., on tea; *Arbela quadrinotata*, Wlk., on cacao; *Brithys crini*, F. (*Glottula dominica*, Cram.), destroying lily foliage; *Eupterote petosiris*, Cram., (*geminata*, Wlk.), defoliating dadap (*Erythrina*); *Dichomeris ianthes*, Meyr., defoliating lucerne; *Phyllocnistis citrella*, Staint., on citrus; and *Hypocala moorei*, Butl., defoliating *Diospyros montana*; the butterflies, *Rapala schistacea* feeding on flowers of tea, and *Catochrysops pandava*, Horsf., in fronds of Cycas; and the beetle, *Xyleborus fornicatus*, Eich., in twigs of avocado pear.

RUTHERFORD (A.). **Some Minor Pests of Tea Recently Reported.**—*Trop. Agric., Peradenyia*, xliii, no. 6, December 1914, pp. 440–442.

Minor tea pests, recently reported, include:—*Euproctis* sp., probably *atomaria*, Wlk., reported from Peradeniya in May; the weevil, *Astycus immunis*, Wlk., recorded as eating the young shoots just sprouting from the stumps, in May; *Callicratides rama*, Kirby, a Capsid, reported to cause brown spots on the young flush, also occurring on cotton, and easily collected in small hand-nets. The bugs, *Riptortus pedestris*, F., and *R. fuscus*, F., feed on the young unopened leaves or the veins of more mature leaves, seeking shade within the tea bushes during the heat of the day; *R. pedestris* is also recorded as a minor pest of wheat and pulses in S. India, and *R. linearis*, F., has been taken on the foliage of seedling *Hevea* in Ceylon. Thrips, probably *Heliothrips* sp., feed in colonies on both sides, chiefly the lower one, of the older leaves, and what is probably the same species occurs on a variety of plants, including avocado pear and *Litsea zeylanica*, but is never numerous enough to do much harm. Pulling the leaves and dipping them at once into water bearing a layer of kerosene, will kill the insects, while in the case of bad infestation, the plants should be sprayed with kerosene emulsion or a tobacco decoction. Another thrips, probably *Heliothrips* sp., found in large numbers on the leaves of *Careya arborea*, the Patana oak, at Peradeniya, was seen to be heavily parasitised by a very small Chalcid. *Coccus hesperidum*, L., occurred on the upper surfaces of citrus leaves in Nawalapitiya, the attack being slight. *Saissetia hemisphaerica*, Targ., seriously attacked twigs in June, the leaves being often found covered with sooty mould, a fungus growing on the sugary secretion of the Coccid, the insect itself occurring higher up on the plant. The worst colonies should be cut out and the remainder sprayed with kerosene emulsion, which will also clear away the fungus. *Coccus viridis*, Gr., *Aspidiotus rapax*, Comst. (*camelliae*, Sign.), *Howardia biclavis*, Comst., and *Lecanium* sp., probably *discrepans*, Gr., were present on plants received in June from Lindula. *Ripersia theae*, sp. n., covers the twigs in the same way as mealy bug; on one occasion, though the twigs were covered with the waxy secretion, scarcely a Coccid could be obtained, probably owing to the presence of the larvae of *Spalgis epius*. A sample of made tea infested by a small beetle, probably *Lasioderma testacea*, was received; treatment with carbon bisulphide is recommended against it.

Lewin (G. F.). **The fruit-fly.**—*Agric. Gaz. N. S. W., Sydney,* xxv, pt. 12, December 1914, p. 1089.

Dacus tryoni (the Queensland fruit-fly) is very susceptible to changes in temperature; it has attacked loquats as early as November, though in other years it has not appeared until February; unusual cold in winter does not affect this fly, but excessive rain from May to September destroys large numbers, especially if the ground is muddy. The last brood of maggots in the autumn hibernate in the soil, and as many are destroyed there, the first brood in spring is small, each successive brood becoming more numerous. Small, flat vessels of kerosene placed on the sunny side of the tree will catch a few flies, but the only reliable method is the destruction of the affected fruits, immersing in water being preferable to either burning or burying; six or eight hours under water will destroy every maggot. In 1913, the writer destroyed the larvae in water and then fed cattle with the fruit, which seemed to increase their milk supply.

Allen (W. T.). **Orchard Notes.**—*Agric. Gaz. N. S. W., Sydney,* xxv, pt. 12, December 1914, pp. 1098–1100.

Spraying is necessary in this State against the codling moth, scale-insects and other pests, late varieties requiring four applications to secure satisfactory results. For scale-insects, either fumigate or spray with resin soda wash; never fumigate during the heat of the day, nor soon after the trees have been sprayed with Bordeaux mixture. For fruit-fly, all fallen fruit should be collected and destroyed by burning or boiling; kerosene traps are advised, shallow tins hung on the sunny side of the trees, being preferable to deep ones. Cherry, pear and other trees affected with pear slug [*Eriocampoides limacina*] should be sprayed with lead arsenate. Vine moth [*Polychrosis botrana*] has been common; spraying with lead arsenate of the strength prescribed by the codling moth regulations, will be found a satisfactory measure against it.

Boucher (W. A.). **The Orchard.**—*Jl. Agric., Wellington, N. Z.,* ix, no. 6, December 1914, pp. 493–494.

As a remedy for mussel scale (*Lepidosaphes* sp.), red-oil emulsion in the proportion 1 to 60 has been used to advantage. Where the woolly aphis [*Schizoneura lanigera*] is reappearing, the isolated colonies should be painted with undiluted, red-oil emulsion. The best treatment for codling moth [*Cydia pomonella*] is to begin spraying with lead arsenate just after the petals have fallen, repeating this at fortnightly intervals, weather permitting, till the end of February. Lead arsenate is useful for all chewing insects, hence this persistent spraying will also destroy any bronze beetle and leaf-rolling caterpillars that may be present. In mixing lead arsenate, the substance should be placed at the bottom of the vessel and the water added gradually, in small quantities. In preparing Bordeaux mixture, the lime should be slaked as gradually as possible.

FRYER (J. C. F.). **The Raspberry or Clay-coloured Weevil.**—*Jl. Bd. Agric., London,* xxi, no. 9, December 1914, pp. 832-835.

The year 1914 seems to have been favourable to *Otiorrhynchus picipes*, variously known as the clay-coloured, red-footed, or raspberry weevil, and complaints of its ravages were received from the end of April to the beginning of July. In one case in the west of England, an orchard, before planting, was partly rough pasture, with much bracken, and partly old cultivated garden land. It was noticed that the trees on the latter had almost escaped injury and that even in the affected portion of the orchard the intensity of the attack varied within wide limits from tree to tree. The larvae of the weevil must have fed on the roots of the trees and bushes. It may be assumed that the weevils were all bred in the orchard where the damage was done and that they are unwilling to travel far along the surface. While trees on the old garden land were barely touched, others only a few yards away on the old pasture land were completely defoliated, and the weevils were reduced to feeding on the bark and twigs. It may reasonably be assumed that the partial cleaning of the orchard would destroy a great number of shallow-rooted weeds, while clumps of deep-rooting forms, such as bracken, would be likely to have persisted here and there. *Otiorrhynchus* larvae must have concentrated round such roots and the adults are likely to have emerged from these areas and the neighbouring trees suffered. As feeding only takes place at night and the beetles descend into the soil by day, they would probably, unless possessed of a migratory instinct, attack the same trees night after night. From the practical point of view, the necessity of taking full precautions against insect pests whenever rough pasture or derelict land is brought under active cultivation is evident, since insects which are little harmful to pasture may become destructive pests under fresh conditions. In the case mentioned above, spraying with lead arsenate was not successful, and the laborious and expensive process of hand collection was employed nightly for many weeks in order to save the trees from complete destruction.

FRYER (J. C. F.). **Pea and Bean Thrips, or Black Fly.**—*Jl. Bd. Agric., London,* xxi, no. 9, December 1914, pp. 835–837.

Frankliniella robusta, Uzel, formerly called *Thrips pisivora*, the pea thrips, a short description of which is given, is distributed over the whole of England and is also recorded from Ireland. The southern and eastern counties suffer most. The eggs are laid in June in the tissues of the stamen sheaths and young pods, rarely in the petals of the flower. They hatch in about nine days and the small orange-coloured young feed on the petals, stamens, etc., and later, on the pods. After three or four weeks, they leave their food plants and descend into the soil, where they remain quiescent until the spring, when they pass through two stages, which, together, may be likened to the pupal stage of other insects. They mature about a month later and leave the soil in May and June. The species here described is only known with certainty to attack the edible pea and the broad bean, or varieties of these plants. This pest is difficult to deal with when the attack is in progress, but fields affected during the summer, should be ploughed deeply and, if possible, should receive a dressing of lime the following winter. In gardens, the lime may be replaced by naphthaline or other soil fumigants.

De Charmoy (D. d'E.). **Summary of Investigations on Insect Pests during the five months, July–November, 1914.**—*Mauritius Dept. Agric., Div. Entom.*, 4th December 1914, 2 pp.

When maize was sown in the spaces between blocks of sugar-cane infested with *Sesamia vuteria* (*nonagrioides*) on an estate in Moka, the results were excellent, the young plants being practically free of borers, while other fields, in close proximity, were badly infested. Since the caterpillars remain grouped on the maize for some days, the destruction of these plants destroys the borers on a large scale. Fresh seed should be sown in the place of attacked plants that have been uprooted. Plants 2 feet high should be removed, buried or fed to animals. *Ceraphron beneficiens* has been found parasitising *Sesamia* eggs, and should be bred and liberated in infested fields. Against *Porpe bjerkandrella*, the caterpillars of which were prevalent on artichokes, Paris green or lead arsenate should be sprayed on the plants early or even before signs of infection. "Pou à poche blanche," *Pulvinaria iceryi* (*gasteralpha*), a serious pest of sugar, has been investigated, as also its parasite, *Aphycus* sp. The Pois Sabre borer was observed in the north of the island, seriously injuring Pois Sabre (*Canavalia ensiformis*) and completely destroying the plants when grown in rotation. This pest can only be controlled by cutting out the egg-masses with a knife, or destroying them *in situ*, by pressure, since the larvae eat their way into the plants immediately after hatching.

Norme per la disinfezione delle viti destinate al commercio. [Regulations for the disinfection of vines intended for commercial purposes.]—*Riv. Vitic. Enol. Agrar., Conegliano*, xx, no. 24, 15th December 1914, p. 561.

Provincial Phylloxera inspectors and technical inspectors are required to be present at the disinfection of slips and graftings, if requested to do so by the proprietor of a vine nursery. The operation is conducted in the manner adopted in Government nurseries—viz., the material is submerged for 5 minutes in hot water in wooden tanks. At the moment of immersion the temperature of the water must be 132° F., and it must not fall below 128° F. during the operation. The water must be stirred in order to ensure uniformity of temperature. The inspector is strictly required to be present throughout the operation, which must be suspended during any absence on his part. After treatment, the material must be bound up in bundles, and these may be secured with a lead seal stamped by the official, who may issue a certificate if such be desired.

Somes (M. P.). **The Acridiidae of Minnesota.**—Supplement to *Fifteenth Rept. Minnesota State Entom., 1913 and 1914, St. Anthony Park*, 1st December 1914, 100 pp., 4 pls., 10 figs.*

This is a monograph of the Acridiid grasshoppers of Minnesota, giving field notes, life-histories, and distribution, with keys to the genera and species. A bibliography of 17 works is appended.

* Also published as Bulletin no. 141 (Technical) of the Minnesota Agricultural Experiment Station, July 1914.

WASHBURN (F. L.). **Useful Birds found in Minnesota.**—*Fifteenth Rept. Minnesota State Entom., 1913 and 1914, St. Anthony Park,* 1st December 1914, pp. 1–19, 3 plates.

This paper gives a short account of the habits of 21 insectivorous Minnesota birds, each being illustrated by a coloured figure.

WASHBURN (F. L.). **Report on Inspection of Minnesota Nurseries and of Imported Nursery Stock and Ornamentals, 1913-1914.**—*Fifteenth Rept. Minnesota State Entom., 1913 and 1914, St. Anthony Park,* 1st December 1914, pp. 20–51, 2 plates.*

After outlining the inspection work of 1913, it is reported that the most abundant and injurious insects were *Empoasca mali* (apple leaf-hopper), *Melasoma scripta* (striped poplar beetle), and the apple aphis. A. J. Spangler reports large blocks of apple trees being severely checked in their growth by the first-named pest. The increasing acreage devoted to the growth of poplar and willow cuttings has apparently had a similar effect on the numbers and severity of attack of *M. scripta*, this insect being present in every nursery growing its host plants. It is a voracious feeder, and if the trees are not sprayed upon its first appearance, becomes hard to control.

A list of the nurseries inspected in 1913 is given. In 1913, a new nursery and orchard inspection law was passed, making inspection compulsory, establishing a fee of $5.00 for each certificate granted, and articulating with the provisions of the new Federal quarantine laws. A copy of the State law (approved 8th April 1913) is appended, and several problems connected therewith discussed.

Woolly aphis of the apple [*Schizoneura lanigera*] and oyster-shell scale [*Lepidosaphes ulmi*] are apparently on the increase in Minnesota, but one insect not frequently observed, though presumably more abundant in old orchards than the public is generally aware of, is the San José scale [*Aspidiotus perniciosus*]. A fruit tree may be badly infested with oyster-shell scale and still survive, but it generally succumbs to the attack of one-fourth or one-half as many San José scales. This much-dreaded insect has been found by the inspection force three times in Minnesota nurseries, twice upon stock in two different nurseries shortly after importation from Pennsylvania, and in the 1914 inspection upon mountain ash received from Michigan a few years previously. The female scales upon these latter trees had matured and given birth to young which had infested an adjoining block of young apples. Young scales were found crawling about amongst the parent scales upon the apple and ash trees as late as the latter part of August. These mature scales must have lived in Minnesota at least two winters, and experimentally, San José scales have been kept alive out-of-doors on plum and apple for two succeeding winters. It is apparent, therefore, that this scale will endure the Minnesota climate long enough to do considerable damage.

The inspection work of 1914 is outlined, and abstracts of inspection laws in the individual States and Canada conclude this report.

* Also published as Circular no. 31 of the State Entomologist's Office, November 1914.

RUGGLES (A. G.). **Some important tree insects.**—*Fifteenth Rept. Minnesota State Entom., 1913 and 1914, St. Anthony Park.*, 1st December 1914, pp. 54–56, 2 plates.

The injury done by borers to the several species of oak has been the subject of inquiry. In Minnesota, the adults of *Agrilus bilineatus* (two-lined chestnut borer) occur between the 15th June and the 15th July, during which period the eggs are laid singly or in batches in natural crevices in the bark. The grubs bore into the bark until they reach the wood. After burrowing their length in the wood, they return to the cambium, where all the injurious burrows are made. During the early stages, the burrows follow the grain of the wood, but later, particularly in the last stage, the burrow is almost always across it. It is at this time that the tree is being actually girdled, and if the burrows extend far enough, or if the grubs are numerous enough, the tree dies. In August most of the grubs have made their pupal chambers in the bark, though pupation does not actually take place until the following June. As these insects live concealed beneath the bark, very few natural enemies have been noted ; two, however, are a larval parasite—*Atanycolus* sp., and an egg parasite belonging to the TRICHOGRAMMATIDAE. For the same reason, no artificial remedy has yet been found to kill this insect, the only period when it is open to attack being while the beetles are ovipositing. Experiments show that iron-sulphide or Bordeaux mixture, sprayed on the trunks of trees, discourage the visits of the adults. Some relationship exists between these insects and a disease, the shoe-string fungus, though which, if either, is a primary cause of death to the tree, requires further investigation.

To combat the fall canker worm [*Alsophila pometaria*] and the cottony maple scale [*Pulvinaria innumerabilis*] successfully, absolute co-operation among all concerned and long tedious efforts are necessary.

Another insect doing considerable damage, and new to Minnesota, is an oak twig-girdler, the work of which is entirely different from that of the oak twig-pruner. The tree seems to be infested with blight, many of the leaves on the ends of the small twigs withering. The damage is done by a small grub, closely allied to that of *Agrilus bilineatus*, the adult being as yet unknown.

A thorough spraying, at least twice during the season, with arsenate of lead paste at the rate of 3 or 4 lb. to 50 U.S. (41·6 Impl.) gallons of water is thought to be effective against *Melasoma scripta*. In certain localities, a parasite, a species of *Tetrastichus*, destroys over 60 per cent. of the grubs of this pest. Elms and willows have suffered considerably from the spiny elm-caterpillar [*Vanessa antiopa*] ; spraying with arsenate of lead, as for *Melasoma*, will keep them in check. A bacterial disease has also been observed to kill many of the caterpillars.

General recommendations against scale-insects conclude this paper.

MOORE (W.). **Truck Crop Insects.**—*Fifteenth Rept. Minnesota State Entom., 1913 and 1914, St. Anthony Park,* 1st December 1914, pp. 64–68, 3 figs.

White grubs, *Lachnosterna* spp. [see this *Review*, Ser. A, ii, p. 693], are expected to be troublesome during the summers of 1915 and 1916, and will appear again as adults in great abundance in 1917. On

1st June 1914, the author and two assistants collected in an hour around electric lights 1,928 beetles, of which 1,424 were females, with an average number of 52·7 with eggs which had not been laid.

Two other insects which attracted considerable attention during the summer of 1914 were the cabbage and onion maggots [*Chortophila brassicae* and *Hylemyia antiqua*].

Success in the control of the melon aphis depends upon immediate treatment when the plants become infested. The plants should be examined about the time they send out their runners and the Aphids looked for on the under sides of the leaves. Their presence is also sometimes plainly shown by the curling of the leaves. If only a few plants are infested they should be destroyed ; otherwise carbon-bisulphide or tobacco fumigation (preferably the latter) should be undertaken.

One teaspoonful of "Nicofume" or similar tobacco extract to each U.S. (·83 Impl.) gallon of water makes a solution strong enough to kill the larvae of the cucumber beetle [*Diabrotica*] on the underground parts of the plant. A cupful of the mixture is applied to each plant, the treatment costing about 1*s*. 8*d*. per 100 hills.

BACK (E. A.) & PEMBERTON (C. E.). **Life-History of the Melon Fly.**—*Jl. Agric. Research, Washington, D.C.*, iii, no, 3, December 1914, pp. 269–274, 5 tables.

The damage caused by *Bactrocera cucurbitae*, Coq., to fruit and vegetables in the Hawaiian Islands, is nearly, if not quite, as serious as that caused by *Ceratitis capitata*, Wied. ; less than 30 years ago excellent cantaloups and water melons were grown in profusion, but to-day *B. cucurbitae* is found on all the important Hawaiian islands and these crops can only be grown on new land which is distant from old gardens. More than 95 per cent. of the pumpkin crop is annually ruined and much havoc caused among the more resistant cucumbers. *B. cucurbitae* oviposits in set fruit, but more often, in the case of the pumpkin and the squash, in the unopened male and female flowers, in the stem of the vine and even in seedlings, especially in those of the water melons and cantaloup. Whole fields of water melons have been killed before the plants were 6 or 8 inches long by larvae boring into the taproot, stem and leaf-stalks. Besides cucurbitaceous crops, some leguminous ones, such as string beans and cow-peas often suffer severely ; failing these, even peaches, papayas and similar fruits are attacked to a limited extent. No satisfactory remedy is known to prevent the infestation of fruit, though Chinese gardeners save a small percentage of their crop by covering the young fruit with cloth or paper, or, in the case of cucurbits, by burying them in the soil until they become sufficiently large to withstand attack. The female deposits her eggs in small batches, beneath the surface of the fruit, vegetable or plant affected. The egg stage is short, varying from 26 to 51 hours. The larva passes through 3 instars before pupation, the larval period varying from 4 to 7 days ; those developing in pumpkins and other thick-skinned fruits often remain in the fruit several days longer before emerging. The pupal stage ranges from 7½ to 13 days. The adults live for from 6 to 12 months. Sexual activity begins only at sunset, and the flies are rarely sexually mature until 25 days after emergence from the pupa.

LAMBORN (W. A.). **The Agricultural Pests of the Southern Provinces, Nigeria.**—*Bull. Entom. Research, London*, v, pt. 3, December 1914, pp. 197–214, 4 figs., 9 plates.

An account is given of the insect pests and methods for their control, observed in the Southern Provinces, Nigeria, between May 1913 and May 1914. Cotton pests included:—The Tineid, *Acrocercops bifasciata*, Wlsm., which mined the young leaves, and *Aphis gossypii*, Glov., which was abundant in August, but was checked by natural enemies, especially *Chilomenes lunata*, F., *C. vicina*, Muls., and *Hyperaspis pumila*, Muls., also to a less extent by *Syrphus nasutus*, Wied., *Paragus borbonicus*, Macq., *P. longiventris*, Bezzi, and *Micromus timidus*, Hagen. *Zonocerus variegatus*, L., the worst cotton-leaf pest, occurred suddenly in November and entirely defoliated many plants. This locust was practically omnivorous, and also attacked young maize, Para rubber, cassava, bananas, and occasionally cacao. The leaf-roller, *Sylepta derogata*, F., was abundant about November on certain imported varieties, notably American Upland, but was less numerous on the native ones; Tachinid parasites, possibly of two species, the Ichneumonid, *Xanthopimpla punctata*, F., and some BRACONIDAE, were bred from the pupae, but were not numerous enough to be effective checks; insecticidal sprays failed owing to the difficulty of getting the poison on to the rolled-up part of the leaf, so hand-picking by native boys was resorted to, the various cotton-stainers being collected at the same time. *Parasa infuscata*, Wichg., was not uncommon; green half-looper Noctuid larvae were prevented from causing any serious damage by a wasp, *Eumenes maxillosa*, de Geer, which stored them in its mud cells. *Lagria villosa*, F., *Syagrus calcaratus*, F., and other beetles cause some leaf damage. The scale-insects, *Hemichionaspis minor*, Mask., and *Pulvinaria jacksoni*, Newst., occur in small numbers; the former was checked late in the season by the larvae and imagines of *Chilocorus schiödtei*, Muls. A Buprestid beetle, *Pseudagrilus sophorae*, L., caused considerable damage by boring the stems; destruction of the affected plants seemed to be the only remedy. A number of plants were destroyed by the decortication of their roots by the larvae of a Lamellicorn beetle; the application of a 1 in 200 aqueous solution of carbon bisulphide to the roots, by means of the Gastine apparatus [see this *Review*, Ser. A. ii, p. 256], gave promising results. *Diparopsis castanea*, Hmp., was abundant, and in some instances the pupae of this moth lay dormant in the ground for many months instead of the usual 8 or 10 days. *Earias biplaga*, Walk., was found in flower-buds as well as in bolls, and was also observed feeding on the leaves and in seed-pods of the fibre plant, *Sida carpinifolia*, L., and on leaves of several bush plants; *Rhynchium ventrale*, Sauss., a Eumenid wasp, was an important check on the larvae of this moth. *Pyroderces simplex*, Wlsm., and *Mometa zemiodes*, Durrant, were found abundantly in June, in late bolls on plants of the previous season, but were not seen again until the cotton season was well advanced; these moths are not so injurious as the former pests, confining themselves to the seeds in opened bolls, though their activities continue in stored cotton, larvæ being found alive in the seed even after ginning. The larvae of both species are parasitised by *Chalcis olethrius*, Waterston. Collecting and destroying affected bolls seems to be the only suitable method of control, though the

soil should be thoroughly dug up at the end of the season to expose aestivating *Earias* pupae. The cotton-stainer, *Dysdercus superstitiosus*, F., was found in some numbers during the dry season, but *D. nigrofasciatus*, Stål, *D. melanoderes*, Karsch, and *Oxycarenus dudgeoni*, Dist., were not abundant. *D. superstitiosus* and *D. melanoderes* occasionally interbreed. Small nets were successfully employed for collecting immature cotton-stainers, the larger net used in the West Indies being found impracticable. Shaking the insects into wide-mouthed tins containing water and a little kerosene is a simple method suitable for the native farmer, but hand-picking is probably the most efficacious method of control. Mixed cultivation decreases the spread of insect pests, though other Malvaceae should only be planted in the vicinity as a trap, okra being especially recommended for this purpose. Intercalated rows of maize serve as a protection.

Among cacao pests, colonies of a Psyllid, *Udamostigma tessmanni*, Aulm. var., occurred, but were successfully combated by brushing with kerosene emulsion. Black Aphids were effectively checked by natural agencies. The chief insect pest was a Rutelid beetle, *Adoretus hirtellus*, Castn., which invariably attacks young plants, feeding by night and hiding by day, often about the roots. Other pests of cacao leaves were :–*Zonocerus variegatus*, L., a Melolonthid, *Trochalus carinatus*, Schönh., and the caterpillars of *Metisa sierricola*, White, *Diacrisia maculosa*, Cram., and *Earias citrina*, Saalm. The ant, *Oecophylla smaragdina longinoda*, Latr., is probably invaluable in keeping off insect pests other than COCCIDAE. To combat these leaf-eaters, the plants were dusted in the wet season with a mixture of Paris green and lime ; later on, spraying with lead chromate in solution was substituted to avoid scorching. The caterpillars of *Eulophonotus myrmeleon*, Feld., were the only cacao stem-borers found ; in order to kill the larvae tunnelling in the main stems, injections of carbon bisulphide were made into the bore-holes, which were immediately plugged with a pellet of clay and tarred. Special search was made for the boring beetle recorded as attacking cacao on the Gold Coast, but it was not found. Some trees showed evidence of attack by what was almost certainly the larva of an Aegeriid moth. *Sahlbergella theobroma*, Dist., occurred sparingly. A species of *Pseudococcus*, either *longispinus*, Targ., or *virgatus* var. *madagascariensis* occurred, but was effectively checked by the caterpillars of a butterfly, *Spalgis lemolea*, H. H. Druce ; brushing with kerosene emulsion was found less harmful than spraying. *Stictococcus sjöstedti*, Newst., is protected by *Oecophylla* ; its natural enemies include the caterpillars of the moths, *Eublemma ochrochroa*, Hmp., and *Tortrix callopista*, Durrant, and at one place this scale showed signs of parasitism by Chalcids. *S. dimorphus*, Newst., occurred, probably owing to the use of *Cajanus indicus* for shade purposes, but was greatly checked by *Eublemma scitula*, Ramb. The Anthribid beetle, *Araecerus fasciculatus*, de G., and a Noctuid, *Characoma stictigrapta*, Hmp., were not uncommon attacking the pods. *Stictococcus dimorphus*, Newst., occurred especially on the yellow Amelonado cacao, and was guarded by the red ant. *Ceratitis nigra* Grah., was captured in great abundance, but its relation to the pods was not determined. A large ant, *Paltothyreus tarsatus*, F., was useful in carrying off the termites, which were successfully combated with the "Universal

Ant Destroyer," a machine, by means of which, arsenical and sulphurous vapours, with a mixture of carbon monoxide and dioxide, are pumped into the termitarium.

Kola pests included a small Fulgorid, *Pundaluoya simplicia*, Dist., found commonly at the tips of young shoots, which were treated by brushing with a weak kerosene emulsion. Young nursery plants were much attacked by the *Adoretus* beetle and by *Zonocerus variegatus*, L. Kola nuts, both on the tree and in store, were attacked by the weevils, *Paremydica insperata*, Fst., and *Balanogastris kolae*, Desbr., which were parasitised by an Ichneumonid. Among coffee pests, a moth, *Metadrepana glauca*, Hmp., and a *Stictococcus* were observed.

Maize pests included the moths, *Prodenia litura*, F., *Cirphis loreyi*, Dup., *Sesamia calamistis*, Hmp., *Eldana saccharina*, Walk., and *Busseola fusca* Hmp., and an earwig, *Elaunon erythrocephalus*, Oliv., which damaged green maize. *Sesamia* only damages the seed by pupating in the heart of the cob, while *Eldana* eats the grains, both pests being checked by a Tachinid fly, which is itself sometimes parasitised by a Encyrtid parasite. *Sesamia* and *Eldana* were found in maize stems long after the cobs had been picked. Towards the end of the maize season, *Mussidia nigrivenella*, Rag., a common pest of stored grain, was found in the almost ripe cobs. For the control of these pests the maize should be harvested as early as possible and maize refuse burned, or failing this, buried under a few inches of earth in the wet season. Stored maize was attacked by *Calandra oryzae*, L., *Tribolium confusum*, *Tenebrioides mauritanicus*, L., *Mussidia nigrivenella*, Rag., and *Ephestia cautella*, Walk. Chalcids were discovered breeding in *Calandra* larvae. On 30th October, four female *Mussidia* mo ths wereplaced in a jar containing 8 oz. sound maize. Oviposition took place at once and at the end of two months, when two generations had completed their life-cycle, the maize had lost 25 per cent. in weight, and 50 per cent. of the grain was attacked. Fumigation with carbon bisulphide at the rate of 5 lb. per 1,000 cubic feet of space was tried, the operation extending over five days, the immediate results were satisfactory, but at the end of three months, weevils and grain beetles re-appeared ; fumigation had to be repeated, the result being that the germinating power of the seed was affected. Test experiments in fumigating with carbon dioxide, on a small scale, gave entirely satisfactory results.

Para rubber plants were singularly free from pests, but *Z. variegatus* and a large cricket, *Brachytrypes membranaceus*, Drury, which was preyed on by a fossorial wasp, *Chlorion xanthoceros*, Illig., var. *instabilis*, Sm., were noted. *Funtumia elastica* is attacked by two Lepidopterous leaf-eaters, the larva of a species of Sphingid moth of the genus *Nephele*, which is much parasitised by Braconids, and the larva of *Glyphodes ocellata*, Hmp., which specially attacks young young plants. *Funtumia* pods contained a variety of pests, viz. :—caterpillars of *Entephria sexpunctalis*, Hmp., a beetle, *Berginus tamaricis*, Woll., and a Lygaeid bug, *Arocatus continctus*, Dist.

Ground-nuts were attacked by Psychid caterpillars, *Metisa sierricola*, White, and a scale-insect, *Ceronema africana*, Macfie.

Bean pests included the beetles, *Lagria villosa*, F., *L. viridipennis*, F., and *Ootheca mutabilis*, Sahlb., and pigeon peas (*Cajanus indicus*) were attacked by *Ceronema africana*, *Stictococcus dimorphus*, Newst.,

and a species of *Icerya*. The seed was attacked by the caterpillars of *Marasmarcha atomosa*, Wlsm., and *Lampides boetica*, L., while a froghopper, *Ptyelus grossus*, F., fed on the stems.

Calandra oryzae, L., is the only pest of oil palms recorded from Nigeria, though *Derelomus kamerunicus*, Fst., and three other species of the same genus of weevils were found on the flowers in Cotonou, Dahomey.

The hawk-moth, *Herse convolvuli*, L., was the only field pest of sweet potatoes, though stored tubers were considerably attacked by weevils, *Cylas brunneus*, F., and *C. puncticollis*, Boh.

GREEN (E. E.). **Remarks on a Small Collection of Coccidae from Northern Australia.**—*Bull. Entom., Research, London*, v, pt. 3, December 1914, pp. 231–234, 3 figs.

A description is given of COCCIDAE collected near Port Darwin, N. Australia, including :—*Aspidiotus* (*Chrysomphalus*) *fodiens*, Mask., on *Pithecolobium moniliferum*, recorded from Australia only ; *A. orientalis*, Newst., on banana leaves and papaw fruit and leaves, recorded for the first time from Australia ; *A. ficus*, Ashm., on coconut palm ; *A. destructor*, Sign., on coconut palm ; *Hemichionaspis minor*, Mask., on *Buchanania* sp., which had been entirely destroyed either by Coccinellids or Chalcid parasites. As this species is an important cotton pest in the United States, the above natural enemies might be effectively employed ; *Chionaspis dilatata*, Green, on *Pandanus odoratissimus*, hitherto unrecorded from Australia ; *Lepidosaphes beckii*, Newm. (*Mytilaspis citricola*, Packard) and *L. pallida*, Green, on *Citrus acida*, the two species being intimately associated ; *Parlatoria ziziphus*, Lucas, on *Citrus acida* ; *Lecanium* (*Saissetia*) *hemisphaericum*, Targ., on undetermined shrubs and weeds ; *L. pseudexpansum*, sp. nov., on *Pandanus odoratissimus*.

MARSHALL (G. A. K.). **Four New Injurious Weevils from Africa.**—*Bull. Entom. Research, London*, v. pt. 3, December 1914, pp. 235–239, 3 figs.

The following species are described –viz. : *Eremnus fulleri*, sp. n., from the Orange Free State, the adults of which are stated to attack the leaves of maize ; *Hyperoides fragariae*, gen. et sp. n., from Cape Province, which is stated to have injured strawberry plants when the fruit was ripening ; *Tychius gossypii*, sp. n., from Cairo, where it was found on cotton ; *Cyllophorus rubrosignatus*, sp. n., from Natal, injuring cultivated fig trees.

DISTANT (W. L.). **Notes on Some Injurious African Rhynchota.**—*Bull. Entom. Research, London*, v, pt. 3, December 1914, pp. 241–242, 3 figs.

A description is given of *Oxycarenus amygdali*, sp. n., from the Transvaal, reported as infesting peach leaves ; *Arocatus continctus*, Dist., originally described from India and Ceylon is now recorded from Africa on *Funtumia* seeds ; *Pundaluoya simplicia*, Dist., originally described from Ceylon, is recorded from Nigeria and the Seychelles, on kola and cacao.

Durrant (J. H.). **A New Cotton-Seed Moth (*Mometa zemiodes*) from West Africa.**—*Bull. Entom. Research, London,* v, pt. 3, December 1914, p. 243.

The larvae of this moth, *Mometa zemiodes*, gen. et sp. n., were found by Dr. Lamborn destroying the seeds in cotton bolls in Southern Nigeria.

Hampson (Sir G. F.). **Two New Species of Wood-boring Moths from West Africa.**—*Bull. Entom. Research, London,* v, pt. 3, December 1914, pp. 245, 1 col. fig.

The two species described are:—*Duomitus armstrongi*, sp. n., from the Gold Coast, the larva of which bores in the stems of coffee, and *Melisomimas metallica*, sp. n., from Sierra Leone and S. Nigeria, which attacks Albizzia trees.

Waterston (J.). **Notes on African Chalcidoidea.—I.**—*Bull. Entom. Research, London,* v, pt. 3, December 1914, pp. 249–258, 5 figs.

Descriptions of the following Chalcidoidea are given:—*Agaon fasciatum*, sp. n., from Uganda, taken from an unopened wild fig; *Sycoecus thaumastocnema*, gen. et sp. n., from Uganda, from an unopened wild fig; *Chalcis olethrius*, sp. n., from S. Nigeria, parasitic on a cotton-seed moth, *Pyroderces simplex*, Wlsm.

Rutherford (A.). **Some Ceylon** Coccidae.—*Bull. Entom. Research, London,* v, pt. 3, December 1914, pp. 259–268.

Descriptions are given of the following new Coccidae, all of which were found at Peradeniya, Ceylon:—*Aulacaspis flacourtiae*, occurring with *Howardia biclavis* on branches of *Flacourtia ramontchii* and preyed on by *Chilocorus circumdatus* and parasitised by a Chalcid; *Aulacaspis myristicae*, on *Myristica laurifolia* (Wild Nutmeg); *Pseudaonidia oreodoxae*, on stem of Cabbage Palm (*Oreodoxa oleracea*), also on Royal Palm (*Acalypha* sp.) and *Broussonetia papyrifera*, Vent.; *P. irrepta*, on branches of an undetermined plant, possibly *Acalypha* sp.; *Aonidiella pothi*, on *Pothos scandens*, chiefly at the nodes under the bud scales, also on *Loranthus* sp.; *Hemichionaspis alatae*, on branches of *Carsia alata*; *Chionaspis malloti*, on twigs of *Mallotus philippinensis*; *Lepidosaphes erythrinae*, on bark of *Erythrina*; *L. ambigua* and *Aonidia ferreae*, on twigs of *Mesua ferrea*; *Neolecanium cinnamoni*, on the bark of branches of Cinnamon; *Parlatoria mesuae*, on the leaves of *Mesua ferrea*. *Ceronema koebeli*, Gr., is said to be attacked by Hymenopterous parasites, and larvae of the Lycaenid butterfly, *Spalgis epius*, were feeding inside the ovisac of this species.

Fantham (H. B.) & Porter (Annie). **The Morphology, Biology and Economic Importance of *Nosema bombi*, sp. n., parasitic in various Humble Bees (*Bombus* spp.).**—*Ann. Trop. Med. & Parasit., Liverpool,* Ser. T. M., viii, no. 3, 15th December 1914, pp. 623–636, 1 pl.

Nosema bombi, sp. n., is parasitic in the alimentary canal and Malpighian tubules of various species of bumble bees—viz.: *Bombus agrorum*,

B. hortorum, *B. latreillelus*, *B. lapidarius*, *B. sylvarum* and *B. terrestris*. It may also pass naturally to the hive bee, *Apis mellifera*, and to *Apis florea*, and is pathogenic to all of them. The morphology of *N. bombi*, in general, resembles that of *N. apis*. The mode of infection is due to contamination by means of infected food and drink. Larvae became infected in cases were the original pollen mass on which the eggs were laid had been contaminated by the parental excrement. *Nosema bombi* can pass from one species of bumble bee to another without change of morphology or virulence, but when it reaches hive bees, its pathogenic action is increased. The economic importance of *Nosema bombi* is further connected with the fact that the species of *Bombus* are essential for the fertilisation of certain plants of agricultural and chemical importance, the red clover being the best known. The dearth of bumble bees due to the action of *N. bombi* has resulted in less red clover seed in certain districts. Preventive measures include destruction by burning of all dead bumble bees and of the nests of moribund bees, and the prevention of the destruction of healthy nests, more especially by children.

IGLESIAS (F.). *Cycloneda sanguinea.*—*Chacaras e Quintaes, S. Paulo*, x, no. 6, 15th December 1914, pp. 434-435, 3 figs.

This is a reprint of a portion of an article originally appearing in the *Revista do Museo do Ypiranga*, in which the author describes *Cycloneda* (*Neda*) *sanguinea*, L., as being of the greatest value in clearing oranges and rose trees of aphids in Brazil. The Coccinellids were bred from specimens found on orange trees, and their habits and life-history studied. The eggs are laid on the leaves near to a mass of aphids, which the larvae begin to devour greedily so soon as they emerge. Feeding goes on day and night, and the larvae increase rapidly in size. The larval stage lasts about 15 days, depending somewhat on the food available, and the pupal stage from five to six days. The larva, pupa, and imago are described at length. This species can be bred with great ease on aphis-infested orange or rose trees. A rose tree is so arranged that it may be covered by a frame the sides of which are formed of wire gauze. Infested cuttings from other trees are laid among the branches, and, when the aphids have multiplied sufficiently, the Coccinellids may be introduced into the cage, and if there be plenty of food will increase rapidly. Twigs or branches to which many larvae are attached may then be removed and placed on infested trees in the open. Where large areas of orange or rose trees are in question, gauze cages large enough to cover a whole tree should be used.

FULLAWAY (D. T.). **Fruit Fly Control.** *Hawaiian Forester & Agric., Honolulu*, xi, no. 12, December 1914, pp. 349–350.

The author collected in August in Nigeria, and has brought to Honolulu, the following parasites of *Ceratitis capitata*: Both sexes of *Tetrastichus giffardi*, *Diachasma fullawayi*, *Opius* sp., and *Spalangia* sp.; also one undetermined *Eucoila*.

From Teneriffe: Three specimens of an undetermined, metallic Chalcid; also maggots and pupae of *C. capitata* parasitised by *Tetrastichus*.

There is no doubt about the multiplication of *Tetrastichus* in large numbers, but faulty mating interrupted the multiplication of the two Braconids; the author has, however, since succeeded with the multiplication of one of these latter. The *Tetrastichus* is the species which Silvestri discovered in West Africa, but lost on the way home; it was considered by him as one of the most important parasites of *C. capitata* in West Africa, and its introduction is especially recommended in his recent report. [See this *Review*, Ser. A, ii, p. 316.]

EHRHORN (E. M.). **Division of Entomology.**—*Hawaiian Forester & Agric., Honolulu*, xi, no. 12, December 1914, pp. 355–357.

In the course of his report for October 1914, the author records the fumigation of two imported European bay trees on account of their being infested with *Coccus hesperidum*. During the month the following parasites were liberated from the insectary:—For horn-fly [*Lyperosia*] and house-fly, 1,600 African horn-fly parasites, 2,000 Philippine *Spalangia*, 2,000 Philippine Pteromalids; for fruit-fly [*Ceratitis capitata*], 250 *Galesus silvestrii* and 750 *Opius humilis*.

LIÈVRE (A.). **Rapport sur les essais d'un insecticide contre le puceron lanigère, inventé par M. Celestin Duval.** [Report on the trials of a woolly aphis insecticide invented by M. Celestin Duval.]—*Jl. Soc. Nat. Hortic., France, Paris*, xv, July-December 1914, pp. 516–519.

The author was secretary of a committee in whose presence an apple tree strongly infested with the woolly aphis was sprayed with a new insecticide in August 1913, the inventor, M. Celestin Duval, using an ordinary sprayer for the purpose. An hour later all the insects which had been reached by the spray were dead; no scorching was noticed on the leaves. Trees which had been treated by the same method 8 or 10 days before, were inspected and no living aphids were seen. If, as declared by the inventor, no other treatment was carried out, this method is certainly efficient and practical. In July 1914, M. Duval published a pamphlet, "*La destruction du Puceron lanigère*," containing the following formulae:—Potassium carbonate solution, viz.:—Rainwater, 1 litre; potassium carbonate, 4 grammes; sulphoricinate of soda, 40 grammes; methylated spirits, 20 grammes; and tobacco extract containing 10 per cent. nicotine, 10 grammes. This mixture is used on the leaves, young shoots or old wood. It dissolves the wool and the insects are transformed into a thick paste, which soon dries with a greyish appearance.

During the two or three weeks before the leaves are about to fall naturally, when there need be no fear of injuring them, the following more powerful formula should be used, if any aphids still remain: American potash solution:—Rainwater, 1 litre; American potash, 10 or 12 grammes; sulphoricinate of soda, 40 grammes; methylated spirits, 20 grammes; tobacco extract containing 10 per cent. nicotine, 20 grammes. The aphids, though now covered with a thicker coat of wax, are unable to resist this solution. At this time of the year, the eggs which insure the continuation of the species have been laid in

cracks and holes in the bark. They may be destroyed by filling up the holes with the following preparation—Black soap composition:—Rainwater, 1 litre; black soap, 350 grammes; and sulphoricinate of soda, 50 grammes. This mixture is applied with a brush. Finally, in order to destroy the aphids in their last refuge, the roots, to which the females migrate after oviposition, the following operation is performed: A basin-shaped hole is dug at the foot of each tree, so as to uncover the aphids on the roots, which are then sprayed with either of the two solutions. After all the insects have perished, the hole may be filled in. M. Duval states that by faithfully following these directions, orchards may be freed from the pest and it may even be possible to contemplate the destruction of the species if the measures here recommended were universally adopted.

De Rosa (A.). *Phloeotribus scarabaeoides* **and** *Hylesinus oleiperda*, **beetle pests of Olives in the Arezzo District.**—*Il Coltivatore, Casale Monferrato*, lx, no. 28, pp. 301–305, 3 figs.

Control measures are given for the Scolytids, *Phloeotribus scarabaeoides*, Bern. (*P. oleae*, F.) and *Hylesinus oleiperda*, F., which cause considerable damage around Arezzo by mining the olive branches [see this *Review*, Ser. A, iii, p. 99.]

Back (E. A.). **The Mediterranean Fruit Fly in Bermuda.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 161, 18th December 1914, 8 pp.

Investigations into the life-history of *Ceratitis capitata*, Wied., and the possibility of eradicating it from Bermuda, are here detailed. For nearly 50 years the peach industry in Bermuda has been ruined by this pest, which to-day is generally distributed over the islands. The life-history of the fly is given, including data substantiating the author's belief that the life-cycle in Bermuda ranges from two to three months. To the list of host fruits of *C. capitata* already given [see this *Review*, Ser. A, i, p. 161], the ball kamani (*Calophyllum inophyllum*) and the prickly pear (*Opuntia* sp.) are added; the principal fruits supporting *C. capitata* were found to be: the loquat or Malta plum (*Eriobotrya japonica*) which ripens during January, February and March; peaches, which ripen from late March to early July; Surinam cherries (*Eugenia micheli*), of which the first crop ripens in May, and the second during the summer and autumn. The author believes that clean cultural methods, drastically applied, would exterminate *C. capitata* in Bermuda within three years, if the work were carried out continuously, instead of intermittently, as has hitherto been the case. The extermination of the pest would be decidedly to the advantage of both Bermuda and the United States.

I. N. **Къ урожаю подсолнечника.** [On the harvest of sunflower-seeds.]—**« Садъ, Огородъ и Бахча.»** [*Orchard, Market-Garden and Bachza*], *Astrachan*, no. 9, September 1914, pp. 585–586. [Received 15th February 1915.]

The caterpillars of *Homoeosoma nebulella* have done considerable damage to sunflower seed in some places of the district of Zarev (government of Astrachan). The greatest damage was done to the

varieties used for chewing, the loss being 5 per cent., while in the case of oil varieties, it was only from 1 to 2 per cent. In former years, this pest has often totally destroyed the chewing varieties.

Tkatchenko (E.). **Обслѣдованіе полеводства въ Калмыцко-Балкскомъ и Рахинскомъ инструкторскихъ участкахъ Астраханскаго Общества Садоводства, Огородничества и Полеводства.** [An investigation of farming in the Kalmitzkaja-Balka and Rachinsk instruction districts of the Astrachan Society of Horticulture and Agriculture.]—**« Садъ, Огородъ и Бахча.»** [*Orchard, Market-Garden and Bachza*], *Astrachan*, no. 11, November 1914, pp. 712–721. [Received 15th February 1915.]

In both these districts, the greatest damage is done by a flea-beetle, *Haltica* sp., a sawfly, *Athalia spinarum*, F., and a blister-beetle, *Epicauta* sp., all of which chiefly attack mustard, while the last-named during 1914 also injured tomatoes, potatoes and peas.

Отчетъ о дѣятельности Астраханскаго Общества Садоводства, Огородничества и Полеводства за 1912 г. [Report on the work of the Astrachan Society of Horticulture and Agriculture for 1912.]—Supplement to **« Садъ, Огородъ и Бахча.»** [*Orchard, Market-Garden and Bachza*], *Astrachan*, nos. 8, 9 and 12; August, September and December 1914, 132 pp.

This is a series of reports of various sections, institutions, and nstructors of the Society. An outbreak of the webworm *Phlyctaenodes sticticalis*, occurred in 1912 in two districts, causing great damage to field and bachza crops. The budget of the Entomological Station of the Society, which has existed since 1911, was about £400, of which about £200 constituted a government grant. The instructors of the Society were chiefly instrumental in assisting the population in the control of various pests. A. I. Kutin, the chief Instructor of the districts of Astrachan and Krasnogarsk, mentions in his report that *Cydia pomonella*, in some localities, has destroyed nearly two-thirds of the yield of the apple trees and that the caterpillars of *Polychrosis botrana* have destroyed half the vintage in some vineyards. Other pests included *Rhynchites auratus* on cherry trees; *Hyponomeuta malinellus*, *Euproctis chrysorrhoea*, *Psylla pyricola*, *Gryllotalpa gryllotalpa* and *Polyphylla alba*. Bachza plants have also suffered considerably from a fungus (*Orobanche ramosa*) which, however largely decreased towards the end of summer, as it was fed upon by the larvae of a fly, *Phytomyza orobanchiae*.

Schaidurov (P.). **Замѣтка о массовомъ появленіи черемуховой моли.** [Note on an outbreak of *Hyponomeuta padi*, Zell. (*H. variabilis*, Zell. ?)]—**« Записки Уральскаго Общества Любителей Естествознанія.»** [*Bull. Soc. Oural. des Amis des Sci. Nat.*], *Ekaterinburg*, xxxiv, no. 8, 1914, p. 147.

Near the village of Assovo, in the district of Kungur (government of Perm), there are large groves of *Prunus padus*, L. (bird cherry), which, in June 1914, were attacked by great swarms of the

caterpillars of *Hyponomeuta padi*, Zell. The trees were covered with webs, and the number of caterpillars was so great that the foliage appeared black. The inhabitants did nothing to rid the trees of the pest and by June 17th the whole district was swarming with the moths.

Silvestri (F.). **Viaggio in Eritrea per cercare parassiti della mosca delle olive.** [Journey in Eritrea in search of olive-fly parasites.]—*Boll. Lab. Zool. Agrar. R. Scuola Sup. Agric., Portici*, ix, 12th December 1914, pp. 186–226, 24 figs.

In August 1914, the Italian Ministry of Agriculture sent the author to Eritrea in order to collect, for immediate importation into Italy, parasites of *Dacus oleae* (the olive fly). In August and September, 14 species were secured, including: Braconidae—*Opius africanus*, Szépl., var. *orientalis*, Silv.; *O. dacicida*, Silv.; *Sigalphus daci*, Silv.; and *Bracon celer*, Szépl. Chalcididae—*Eupelmus afer*, Silv.; *Halticoptera daci*, Silv.; *Entelus modestus*, Silv.; *Atoposoma variegatum* var. *afra*, Silv.; *Achrysocharis formosa* var. *erythraea*, Silv.; *Teleopterus notandus*, Silv.; *Metriocharis viridis*, Say; *Metriocharis atrocyanea*, Silv.; *Alomphale cavasolae*, Silv.; and *Tetrastichus maculifer*, Silv. These species are described and biological notes of them are given. As regards their economic value in Italy, only an approximate estimate can be made, based on the conditions observed in various localities in Eritrea. At Nefasit, very few olive trees had ripe or ripening fruit in the months of August and September and the olive fly had infested practically all the few fruit available, but at least 90 per cent. of the larvae were parasitised. Olives were plentiful at Dedda and few of the fruit were infested; a proportion of the larvae were parasitised. These observations show that the fly is subject to natural control in Eritrea and that insects are an important factor.

Cochenilles dangereuses. [Dangerous Coccids]—*Rev. Hortic. de l'Algérie, Algiers*, xviii, nos. 7–12, July-December 1914, p. 245.

Pulvinaria psidii is reported on *Schinus terebinthifolia* in Algeria.

Traitement des citronniers. [Treatment of lemon trees.]—*Bull. de l'Union des Agriculteurs d'Egypte, Cairo*, xii, no. 109, November, December 1914, pp. 269–270.

The Egyptian Minister of Agriculture has issued a circular, No. 60, indicating the measures to be taken against the "*ver du citronnier*." Infestation is mostly due to insects left on dead twigs and fallen fruit, and is facilitated by the branches growing near the ground. All low-growing branches should be lopped off, leaving the stem bare up to a height of two feet. A mixture of lime, salt, and sulphur, prepared as directed in circular No. 44,* is then painted on and forms a complete protection. The ground around the trees should be kept free of all dead leaves and fallen fruit. Infestation spreads rapidly when the branches of different trees are interlaced. At least one metre (39 inches) of space should be allowed between the branches of a given tree and those of its neighbour. The grove may have to be thinned to attain this object, but it will result in better crops.

* The circular has not been received by this Bureau.—Ed.

Jack (R. W.). **Chafer Beetles.**—*Rhodesia Agric. Jl., Salisbury*, xi, no. 8, December 1914, pp. 1144–1151, 3 plates.

This is a popular account of the injurious Lamellicorn beetles of Southern Rhodesia, the following being figured : *Schizonycha puncticollis, S. infantilis, Anomala pinguis, A. pallida, Adoretus testaceus, A. picticollis, Pachnoda impressa, P. flaviventris, P. rufa, Rhabdotis sobrina, Diplognatha gagates, Tephraea dichroa, Protaetia carneola, Isandula africana, Leptothyrea* sp., and *Leucoscelis* sp. Chafer beetles destroy leaves, fruit, and flowers, and the root-feeding grubs seriously injure tree roots and crops, including maize. For night-flying chafers, spraying with lead arsenate, 3 lbs. to 50 gals. water, is recommended; light traps may be used as an auxiliary measure, a simple form consisting of a lamp overhanging a tub containing paraffin. Very large numbers can be caught by shaking them from the trees on to sheets. For day-flying chafers, a paraffin tin should be charged with a little water with a film of paraffin on the surface, and the clumps of beetles shaken into it in the early morning. Fruit sprayed with a plain wash of lime is said never to be attacked by the fruit-eating beetles. Early ploughing and thorough cultivation in winter is advised against chafer grubs.

Good Preservative for Native Timber.—*Rhodesia Agric. Jl., Salisbury*, xi, no. 8, December 1914, p. 1182.

The following mixture has been found a good preservative of native timber against borers and white ants : 1 gallon boiled linseed oil and 4 oz. arsenic. Two coats should be applied, the first being allowed to harden for a week before the application of the second.

Ballard (E.). **Administration Report of the Government Entomologist for 1913-14.**—*Rept. Dept. Agric. Madras Presidency, 1913–14, Madras*, 1914, pp. 46–48. [Received 13th March 1915.]

This report contains a list of insects studied during the year. In one estate, where ploughing was performed before the end of January, the egg-masses of the grasshopper, *Colemania sphenariodes*, were successfully destroyed. *Pempheres affinis* (the cotton stem weevil) appears to be spreading outwards from Coimbatore ; it is probably only injurious to Cambodia cotton, though present over most cotton districts. The presence of the cholam fly, the eggs of which have been identified for the first time, in the stems of young cholam is stated to have been proved to be due to the larva boring directly into the plant, not, as hitherto believed, following on the attack of *Chilo simplex*. The eggs of *Calocoris angustatus* (the cholam bug) have been identified for the first time, being found in green cholam grains. There was a bad outbreak at Manganallur of a swarming Noctuid caterpillar, which destroyed the heads of mature rice.

Rutherford (A.). **Notes.**—*Spolia Zeylanica, Colombo*, x, pt. xxxvi, December 1914, pp. 71–78.

The records in this paper are mainly of non-economic importance, but in conclusion the caterpillar of the Pyralid, *Cryptoblabes proleucella*, Hmp., is reported as feeding underneath a web on *Coccus viridis*, Gr.

An Ordinance to prevent and suppress Diseases of Plants and Plant Pests in the Colony of British Guiana. *Georgetown,* no. 12, 18th July 1914. [Received 23rd February 1915.]

In this Ordinance the term "pest" means and includes the Giant Moth-Borer, Mealy Bug, Wood Ants, Beetles, Locusts, Froghoppers, and Cane-fly on sugar-cane; the Leaf-eating Caterpillar, Weevil Borers, and Beetles on coconut and other palms; Rice Bugs, Rice Fly and Grasshoppers on Rice; Thrips and Cacao Beetles on cacao; Scale-Insects and Leaf Insects on Coffee; Scale-Insects, Wood Ants and Leaf-eating Caterpillars on Para Rubber; Leaf-eating Caterpillars, Scale-Insects and White fly on citrus trees; Giant Moth-Borer, and Bees on Plantains and Bananas; Fruit Flies and Scale-Insects on Fruit Trees; Leaf-eating Caterpillars, Aphides, Weevils and Scale-Insects on root crops; Acoushi or parasol ants attacking any crop, and any other pests to which this Ordinance shall be made to apply. Provision is made for inspection and for the treatment of lands on which diseases or pests are found.

Orders of the Board of Agriculture of British Guiana, *Georgetown,* 26th October 1914, nos. 8,456 and 8,457. [Received 23rd February 1915.]

Acting under the above Ordinance, Order No. 8,456 is issued by the Board of Agriculture of British Guiana, as the coconut palm and other palms in the counties of Demerara, Essequibo and Berbice are being injured by *Brassolis sophorae.* All leaves of palms which are being or have been destroyed by this caterpillar are to be removed at the base and either burnt or buried at a depth of not less than 3 feet from the surface. Care should be taken when the leaves fall to the ground that all caterpillars on them be immediately destroyed or fed to chickens. Order No. 8,457 directs that all dying and dead palms in the above-named counties be felled and that both the trunks and crowns thereof be destroyed in the manner indicated above.

Gibson (A.). **The Control of Insects Infesting Mills and Warehouses.** —*Agric. Gaz. Canada,* i, no. 12, December 1914, pp. 961 963, 1 fig.

Ephestia kuehniella (the Mediterranean flour moth), *Plodia interpunctella* (the Indian meal moth), *Pyralis farinalis* (the meal snout moth), *Sitotogra cerealella* (the Angoumois grain moth), *Calandra granaria* (the grain weevil), and *c. oryzae* (the rice weevil) are collectively responsible in various parts of Canada for losses amounting to many thousands of dollars. Recent experiments in the super-heating method of control of these insects are described. The installation of additional radiation in warehouses necessary for this method, can be made at a cost not exceeding the expense of one fumigation with hydrocyanic acid gas, and the super-heating method destroys such minute insects as *Tribolium confusum* (the confused flour beetle), which hides in places inaccessible to hydrocyanic acid gas. In a large food store, which was badly infested with *E. kuehniella,* the heating system consists of steam pipes, box stoves and steam radiators distributed over the three floors. Steam was turned on

and the stoves lighted at 6 p.m., and at 1 a.m. the moths on the top floor began to succumb to the heat of 114° F ; at 10.30 p.m., the following day, when the temperature had reached 120° F. on the third floor, 108° F. in one place and 120° F. in another, on the second floor, no living insects could be seen. When the store was re-visited two weeks later, there were no signs of the insects. Fumigation with carbon bisulphide is recommended for the destruction of dry cereal pests. Before fumigating, the buildings must be made as nearly air-tight as possible ; 4 lbs. of carbon bisulphide should be used for every 1,000 cubic feet of space and the operation performed at a temperature above 70° F. ; the quantity may be doubled for a severe infestation or where the building cannot be sufficiently closed up. The fumigation should last 36 hours and if the grain is not to be used for seed, may be extended to 48 hours. Small quantities of infested grain may easily be treated by filling an ordinary coal-oil barrel, which will hold about 5 bushels of grain, and adding carbon bisulphide, 1 oz. to 100 lb. seed ; this may be poured on the grain or placed in a shallow receptacle, the barrel being closed up tightly, either with a special cap or with fine sacks over which boards are placed with weights upon them. Exposure to the gas should be for at least 36 hours.

WATSON (J. R.). **Tomato Insects, Root-knot and "White-mold."**—*Florida Agric. Expt. Sta., Gainesville,* Bull. no. 125, December 1914, pp. 57–78, 14 figs.

Chloridea (*Heliothis*) *obsoleta* (boll worm, or tomato fruit worm) is the most serious pest of the tomato in Florida ; its favourite food-plant is sweet maize, but it also attacks, among other plants, cotton, green peas and beans. In Florida, there are three or more broods, the winter generally being passed in the pupal stage, but occasionally an adult hibernates. On the tomato, which is attacked mostly in early spring, the eggs are laid on the leaves. The young larvae soon migrate to the stems, into which they bore and as soon as the young fruit are set, they mine inside them. While making their way into another fruit, the larvae may be poisoned by any arsenical with which the fruit is sprayed, especially when the first fruits are so small that they are not able to eat their way inside. Applying arsenicals quite early, when the first fruits are the size of marbles, is advised, because by the time the fruit is ready to pick, the expansion due to growth will have destroyed all signs of spray, even if there has been no rain. Using lead arsenate at the rate of two or three pounds to 50 U.S. (41½ Impl.) gallons of water, the chances of poisoning the consumer, even if the fruit is sprayed only a day or so before picking and is not washed before eating, are negligible. As, however, any trace of the spray on the fruit at the time of marketing would probably interfere with its sale, it is recommended that spraying be discontinued 7 to 10 days before the first picking. If there is no rain, the second spray should be given a week after the first, but should it rain shortly after the first spraying it would be advisable to apply a second spray within three or four days of the first. Even a single spray will greatly reduce the percentage of infestation. In experiments conducted by the author during the summer of 1914, the half-grown fruits were sprayed once, and careful counts a week later showed that

one spraying with lead arsenate killed half the caterpillars present. At the date of spraying, the sprayed rows showed a higher percentage of infestation than the unsprayed ones, on account of their proximity to some maize. In using the lead arsenate spray, two pounds of lime should be added to the liquid to prevent burning. Zinc arsenite has several advantages over lead arsenate; it is cheaper, only one pound being necessary in 50 U.S. gallons of water; it washes off more readily, and there is therefore less danger of any being left on the fruit at picking time, and it is decidedly less poisonous to man than is lead arsenate. Either lead arsenate, zinc arsenite, or Paris green, may be added to Bordeaux mixture. During the summer of 1911 some successful results were obtained in the use of sweet maize as a trap crop, and it is recommended that ten to twenty rows of tomatoes alternate with two of maize. If a single row of maize is planted across the field, it usually does not get thoroughly pollinated, and the ears will not be sufficiently attractive to prevent the caterpillars from wandering to the tomatoes; also, the maize must be planted at such a season as to be in an attractive condition when the first tomatoes are forming, *i.e.*, it must have young silks, otherwise the insect prefers the tomatoes. This maize must be destroyed before it has matured sufficiently to become unattractive to the larvae. Where the acreage of tomatoes is large, the most practical method of disposal of wormy fruits is to dump them into a pond, or to bury them. They should be covered with at least a foot of well-packed soil, more if it is sandy. In one experiment, conducted by Dr. P. H. Rolfs, the infested tomatoes were carefully picked up from one field, while in a neighbouring one they were neglected. In the former at the close of the season there was scarcely any increase in the larvae, and only 5 per cent. of the fruit was attacked, but in the neglected field, 80 per cent. of later pickings was ruined. At the close of the picking season, plants with infested fruit should be burned or ploughed under as soon as possible.

The first preventive measure against root-knot in tomatoes, a disease caused by a nematode, *Heterodera radicicola*, should be to see that the seed-bed is not infested. Three methods of purifying the soil (taken from *U.S. Dept. Agric., Bur. Pl. Ind.*, Bull., No. 217) are given: (i) punch eight or nine holes per square yard into the seed-bed to a depth of a foot, and pour into each $\frac{1}{2}$ oz. (a tablespoonful) of carbon bisulphide, quickly filling the holes with soil, and tramping it down; (ii) saturate the soil with a mixture of 1 part of commercial formalin with 100 of water, using $1\frac{1}{2}$ U.S. ($1\frac{1}{4}$ Impl.) gallons of the mixture per square yard for a shallow seed-bed, and more for a deep one; (iii) for greenhouses, steam should be passed under considerable pressure through the soil by means of iron pipes with $\frac{1}{8}$ inch holes every few inches, or tile drains, laid at the bottom of the beds a foot or two apart. The beds should be covered with straw, sacking or boards, to keep in the heat, which should be maintained from a half to two hours. Place some raw potatoes on the surface farthest from the pipes, and when these are thoroughly cooked all the nematodes will have been killed and the steam may be turned off. In badly infested fields, the plants should be ploughed up and burned, and the field planted during the remainder of the year, and also at least during the year following, with some plant not affected by this worm. Among such immune, or

partially immune, plants are: Most of the fine grasses, including crabgrass; most of the varieties of maize and wheat; rye; some varieties of oats; velvet beans, and beggarweed. Iron and Brabham cowpeas are usually resistant; onions, parsnips, strawberries and turnips are slightly affected. When growing any of these plants to free the land from root-knot, it is important that all weeds (especially careless weed or Amaranth) should be destroyed. A list of forty Florida plants liable to severe attacks is given.

Euthrips tritici projectus (the grain thrips) occasionally does a great deal of damage to tomatoes. The eggs are laid just beneath the surface of the plant tissue in a shallow slit, and under favourable conditions a generation occurs every two or three weeks. Upon hatching, the young at once attack the tenderest part of the blossom or bud. Tobacco decoctions are very effective against this insect, but in spraying, care must be taken to cover the blossom or bud so thoroughly with the solution that the insects cannot emerge without getting wet. As much pressure as possible should be used, for the double purpose of driving the spray into the blossoms, and of frightening the thrips out by force of the impact of the liquid against the flower. Black Leaf 40 should be used in the proportion of about one part to 1,000–1,800 of water; the weaker solutions in about one to 100; while one part of home-made tobacco extract should be used with about ten of water. It is advisable to use an adhesive. In April 1912, the author used the following mixture on tomatoes: Black Leaf 40, $3\frac{1}{2}$ oz., commercial lime-sulphur, $2\frac{1}{3}$ qts., and water, 50 U.S. ($41\frac{1}{2}$ Impl.) gallons, with the result that about 75 per cent. of the thrips present were killed. Lead arsenate or zinc arsenite can be substituted for the lime-sulphur if it is wished to kill the tomato worms or other gnawing insects at the same time; four or five pounds of whale-oil soap may also be substituted for the lime-sulphur. Flour paste makes an excellent spreader for these tobacco extracts [see this *Review*, Ser. A, ii, p. 82].

Cutworms are mentioned as attacking newly-set tomato plants, and two species, *Lycophotia* (*Agrotis*) *saucia* and *Scotogramma trifolii* (*Mamestra chenopodii*), are figured. Early ploughing, and the use of poisoned bran or cottonseed meal are recommended. The two Sphingids most likely to prove destructive to tomatoes in Florida are *Protoparce quinquemaculata* (Northern tobacco worm) and *P. sexta* (Southern hornworm), the latter being much more common in that State. The pupae from the first brood of larvae appear in North Florida in July. The caterpillars are partially controlled by Tachinids and by the Braconid, *Apanteles glomeratus*. Hand-picking is effective, or the plants may be sprayed with lead arsenate or zinc arsenite; Paris green may also be used.

Eriophyes calacladophora, the mite which causes "white-mould," a disease giving the tomato plants a white, fuzzy appearance of the upper portion of the stem, is rarely seen as a tomato pest outside Florida. The following sulphur spray is recommended against it: Caustic soda (98 per cent.) 10 lb., flowers of sulphur 20 lb., and water 20 U.S. ($16\frac{1}{2}$ Impl.) gallons. Other good remedies are: Lime-sulphur solution and dry sulphur, with or without lime. Kerosene emulsion, whale-oil or fish-oil soap, tobacco decoctions, and tobacco extracts are recommended against the tomato aphids, *Megoura solani* and *Myzus persicae;* while flea-beetles, which often attack the leaves and

shoots of young tomato plants in the seed-bed, may be checked by dusting the plants with ashes, air-slaked lime, or tobacco dust, or by spraying with kerosene emulsion or tobacco decoction.

The bulletin concludes with brief notes on the following insects, which, in Florida, occasionally damage tomatoes:—*Epicauta* spp. (blister-beetles); *Leptinotarsa decemlineata* (the Colorado potato beetle); *Celerio lineata* (white-lined morning sphinx); *Prodenia eridania* (semi-tropical army worm); grasshoppers; the suck fly, *Dicyphus minimus*, Uhl.; *Aleurodes tabaci* (white fly of tobacco); and the plant bugs, *Nezara viridula*, *Euschistus variolarius*, *Leptoglossus phyllopus* and *Cicadula* sp.

Scholl (E. E.), Miller (E. A.) & Ayers (E. L.). **Division of Entomology.**—*7th Ann. Rept. Texas, Commiss. Agric.*, *Austin*, 1st November 1914, pp. 18–22. [Received 19th February 1915.]

Laboratory work on *Phthorimaea operculella* showed that when seed potatoes are dusted with equal parts of lime and Paris green, or lime and lead arsenate, very few tubers became infested. Infested tubers can be freed of these insects by fumigating with carbon bisulphide in a closed bin at the rate of 3 lb. of the fluid to 1,000 cubic feet of space for three hours without impairing the germinating powers of the seed. Efforts have been made to find a less explosive substitute, and one of these, "Antimont", is stated to be giving excellent results, especially in keeping insects out of woollen goods and museum specimens. Against red spiders [*Tetranychus bimaculatus*] on strawberry, the growers were advised to spray with sulphur 20 lb., and caustic potash or caustic soda 10 lb., taking especial care to get the spray under the leaves. In October and November, the San José scale was found to be causing serious injury in E. and N.E. Texas, and spraying and pruning demonstrations were given to the growers.

Somes (M. P.). **Entomologist's Report.**—*Bienn. Rept. Missouri State Fruit Expt. Sta., Mountain Grove (1913-14)*, Bull. no. 24, December 1914, pp. 4–19, 2 pls.

Among apple pests, *Cydia pomonella*, L. is found throughout the state, causing losses from 40–70 per cent. of the crop. There are two broods a year throughout the north part of the State and usually three in the south. Spraying with lead arsenate paste (2 lb. per 50 U.S. gals.), or powder lead arsenate (1 lb. per 50 U.S. gals.) is recommended, first as the petals are falling, a second time three or four weeks later, a third time eight or nine weeks after the petals have fallen, and a fourth 12 weeks after the petals have fallen. *Conotrachelus nenuphar*, Hbst. (plum curculio) should be sprayed with the following mixture: lime sulphur, 3 gals., arsenate of lead paste, 5 lb., freshly slaked lime, 4 lb., to 100 U.S. gals. water, applied first as the petals fall, repeated at intervals of one week, three weeks, four weeks, and three weeks. *Saperda candida*, F. (round-headed apple-tree borer) works largely just below the bark. *Chrysobothris femorata*, F. (flat-headed apple-tree borer), a less serious, though more common pest than the above, infests a variety of both forest and orchard trees. The larvae attain maturity in one summer and

emerge as beetles the following spring. Clean culture is an efficient aid to control; many washes are valuable as deterrent agents, but cannot control larvae already in the trunk; soft soap thinned to the consistency of a thick paint by the addition of strong washing soda solution, to 10 U.S. gals. of which 1 pint of crude carbolic acid is added, is advised. Trees already affected by the larvae may be treated during autumn and early spring by means of a knife and a pointed wire. *Ithycerus noraboracensis*, Forst., (the New York weevil) attacks especially young nursery stock; hand-picking and jarring have been practised, and lead arsenate sprays are advised. *Oberea oculata*, Hald., (eye-spotted apple-twig borer), occurs inside apple twigs and can only be controlled by cutting and burning the wilted twigs. Against *Hyphantria cunea*, Dru. (fall webworm), *Malacosoma americana*, F., (apple-tree tent caterpillar) and *M. disstria*, Hb., spraying with lead arsenate and the mechanical destruction of the nests are useful. Other apple pests noted during the year were: *Lygus pratensis*, L., (tarnished plant bug) *Ceresa bubalus*, F., (buffalo bug), *Brachymena 4-pustulata*, F., (four-spotted tree bug), *Oncideres cingulata*, Say, (twig-girdler), *Elaphidion villosum*, F., (twig-pruner), *Mineola indiginella*, Zell., (leaf-roller), *Canarsia hammondi*, Riley, (leaf-skeletonizer), and *Tischeria malifoliella*, Clemens (trumpet leaf-miner).

Among insects attacking pears, *Eriocampoides limacina*, Retz., (pear slug) generally has two, sometimes three broods a year; spraying with arsenate of lead (paste) at 2 lb. per 50 gals. water is recommended. The other pear pests are largely those which infest apple.

Insects attacking peaches include *Conotrachelus nenuphar* (the plum curculio), which is also a general orchard pest. Careful spraying in four plots has given the following percentages free from curculio punctures, 97·5, 96·5, 96·2, and 97·6. Check plots unsprayed showed percentages of 48·7 and 51·3. Spraying with arsenate of lead paste is advised. The first spraying should be done when the husks are nearly all shed, with the following mixture: Arsenate of lead paste, 3 lb.; lime, 3 lb.; water, 100 U.S. gals.; or self-boiled lime-sulphur with arsenate of lead paste 3 lb. per 100 gals. The second spraying should be done from ten days to two weeks later, with the following mixture: Self-boiled lime-sulphur, 15–15–100, with arsenate of lead paste 3 lb. per 100 gals. The third, if necessary, should be repeated from 10 days to two weeks after the second, with the same mixture. Experience has shown that commercial lime-sulphurs scorch the foliage. Great care should be taken to use a nozzle which will throw a fine mist spray and the entire surface of the fruit should be covered with the solution. *Aegeria* (*Sanninoidea*) *exitiosa*, Say (peach-tree borer) is a serious pest throughout the State, being least injurious on stony hills. There is one brood a year, but the egg-laying period ranges from early July to mid-September, so that a tree often contains larvae of varying sizes. *Aphis persicae niger*, Sm., (black aphis of peach) feeds primarily on peach roots, coming to the surface in spring to form new colonies on twigs and leaves. A strong tobacco decoction sprayed on the aerial form and applied about the roots is recommended.

Cherries and plums are attacked by *Conotrachelus nenuphar*, F., *Myzus cerasi*, F., which has been satisfactorily treated with Black Leaf 40, and by *Tetranychus bimaculatus*, Harv., which severely attacks the leaves and fruit of damsons.

Polychrosis viteana, Clem., (grape-berry moth) causes great direct and indirect damage among vines owing to the rot which it encourages. Clean culture is the greatest control factor for this insect ; spraying with arsenate of lead (paste), 2 lb. per 50 U.S. gals., before blooming, and again immediately after blooming and early in July, is advised ; bagging the bunches immediately after fertilisation is effective, when properly done. *Apantesis arge*, Dru. (grape tiger moth) is recorded for the first time as a grape pest. The eggs were noted in masses on grape twigs and petioles on 23rd June. A spray of arsenate of lead (paste) 2 lb. per 50 U.S. gals. proved a satisfactory control. *Desmia funeralis*, Hb. (grape leaf-folder) is controlled by the same lead arsenate paste as recommended for grape-berry moth. For *Typhlocyba comes*, Say, (grape leaf-hopper), clean culture is recommended ; also spraying with kerosene emulsion or whale-oil soap ; for the latter, it is advised to delay the removal of young shoots until just before spraying. *Amphicerus bicaudatus*, Say (the grape cane borer) is usually local and is best controlled by cutting out and destroying all diseased or affected canes.

The strawberry is subject to attacks from white grub, root worms, root louse, and crown borer, none of which is affected by insecticides ; the use of the one crop system reduces their numbers. Against *Pteronus ribesii*, Scop. (the currant worm), spraying the leaves with a solution of powdered white hellebore, 1 oz. to 1 gal. water, is the safest control, but arsenate of lead, 2 lb. paste to 50 U.S. gals. water, is the more effective. *Gymnonychus appendiculatus*, Hart. (native currant moth) is similar in habits and control to the above. *Psenocerus supernotatus*, Say (the American currant borer) is found in the stems of red currant and is best controlled by cutting out and burning all hollow stems in autumn. The female of *Oberea bimaculata*, Oliv., (raspberry cane borer) girdles the cane in two places, about 1 inch apart, and between these inserts a single egg into the pith ; the larva on hatching bores downward through the cane. The only control is to cut off wilted canes 2 inches below the girdle and burn them. *Agrilus ruficollis*, F., (red-necked cane borer) is always present on wild raspberry and blackberry and sometimes occurs in cultivated canes near wild stock, producing external swellings. It may be controlled by cutting out and burning all infested canes during winter and early spring.

Jalysus spinosus, Say, is reported to have injured tomatoes, the nymphs and adults feeding on the juices by puncturing the stem, branchlets and in some cases the fruit itself ; the chief injury is caused by the insects piercing the young ovary or the fruit stems. Spraying with either kerosene emulsion or Black Leaf 40 proved an effective control, but can only be temporary owing to the wide variety of food-plants. Insects which occasionally damage fruit include the grasshoppers, *Schistocerca americana*, *S. damnificia*, *Melanoplus atlantis*, *M. bivittatus*, *M. femoratus*, *M. differentialis*, *M. femur-rubrum*, *Chortophaga viridifasciata*, *Hippiscus rugosus*, *H. phoenicopterus*, *Scudderia curvicauda*, *S. pistillata*, *S. texana*, *Conocephalus ensiger*. *Diapheromera femorata* is always present in small numbers, and *Megaphasma denticrus* has been taken on apple. The Chrysomelid beetle, *Orsodacna atra*, Ahr., was noted early in the spring gnawing the petals of unopened blossoms of peach, apple, pear and cherry. The Tenebrionids, *Helops cistelioides*, Germ., and *H. micans*, F., are frequently found

under loose bark of apple, etc.; they are harmless to the tree, but probably subsist on the decaying bark tissue. The Lucanid, *Platycerus quercus*, Web., was present in considerable numbers, causing extensive damage by devouring the buds of pear; it can easily be shaken off the trees. *Thyridopteryx ephaemeriformis*, Haw., (bagworm) has done serious damage to shade and fruit trees. Hand-picking the bags during winter and placing them in barrels covered with a coarse screen to allow the parasites to develop, is recommended. In summer, arsenate of lead paste at the rate of 2 lb. per 50 U.S. gals. water is an effective control. Against *Aspidiotus perniciosus*, Comst. (San José scale), spraying should be done during the dormant season; on apples and pears either commercial or home-boiled lime-sulphur may be used, but commercial lime-sulphur is dangerous for peaches. *Lepidosaphes ulmi*, Linn., (oyster-shell scale) is common on various fruit and shade trees; the egg stage is passed during the winter; spraying with kerosene emulsion or whale-oil soap when the young scale-insects are crawling about, is recommended. *Aspidiotus forbesi*, Johns. (Forbes' scale or cherry scale), is controlled in the same way as the San José scale. *A. ancylus*, Putn., (Putnam's scale) is seldom a serious pest, except on currant and gooseberry; control as for San José scale. *Chionaspis furfura*, Fitch (scurfy scale) is very similar in life-history to oyster-shell scale and control methods are the same. *Lecanium nigrofasciatum*, Perg. (terrapin scale) is found for the most part on peach, but also on maple and elm. The damage is usually so slight that the expense of spraying for this insect alone is not justified; control by dormant spraying with concentrated lime-sulphur or miscible oils is advised. *Aulacaspis rosae*, Bouché, (rose scale) occurs on most of the Rosaceae, chiefly in damp shady places. For roses and cane fruits, it is advised to cut off and burn all infested stems during winter. *Aspidiotus uvae*, Comst., (grape scale) can be controlled with a dormant spray of lime-sulphur, but this should not be applied to vines when the buds have begun to open; should the scale be discovered during the growing period, two or more washes of whale-oil soap at the rate of 1 lb. per 4 gals. water will check it.

PROTOPOPOVA (A.). **Выгонка персиковъ.** [The cultivation of peaches.]—**« Плодоводство.»** [*Fruit-growing*], *Petrograd*, nos. 7, 9, 10 & 12; July, September, October, & December 1914; pp. 458–459, 609–614, 690–696, & 850–854.

Great damage to peaches is often done by ants, which devour the pistils during the blossoming period, and later attack the ripe fruit. Smearing the trunks and the posts and bars of the espaliers with tangle-foot, turpentine, thick syrup or any other adhesive substance, is recommended as a remedy. *Aphis persicae* attacks peach trees subjected to dry and warm air and also to rapid changes of temperature. Spraying with tobacco extract or fumigation by means of the Hanbold apparatus is recommended. *Eulecanium* (*Coccus*) *persicae* usually occurs in the axils of the branches, whence it spreads over the young shoots, buds and leaves; only a thorough scrubbing with small, stiff brushes is of any avail as a remedy.

PARSHEK (M.). **Развитiе плодоводства и виноградарства, и винодѣлiя въ Туапсинскомъ округѣ, Черноморской губернiи.** [The development of horticulture, viticulture and wine-making in the district of Tuapse, govt. of Tchernomorsk (Black Sea).]—**«Плодоводство.»** [*Fruit-growing*], *Petrograd*, nos. 11, & 12; November & December, 1914; pp. 739–749 & 829–844.

Apple trees in this district are damaged by *Cydia pomonella*, which frequently destroys one-third and even one-half of the total yield. They are also attacked by Cetoniid beetles, *Epicometis* and *Oxythyrea*, and by various Lepidoptera, especially *Cossus cossus* (*ligniperda*). From 1 to 2 per cent. of Scalecide is reported as the best remedy against aphids, the control of which is rendered difficult by the nature of the ground, which prevents the use of horse-sprayers. Pear trees are damaged, in addition, by *Tingis pyri*, and plums by *Cydia* (*Grapholita*) *funebrana*.

TZESHEVSKY (S.). **Краткое руководство по борьбѣ съ вредителями плодоваго сада, изъ класса насѣкомыхъ. (По перiодамъ года).** [A short text-book on the control of insect-pests of orchards. (Arranged according to the seasons of the year).] Supplement to **«Плодоводство.»** [*Fruit-growing*], *Petrograd*, 1914, 44 pp., 37 figs.

This book contains an introduction by its Editor, J. Schreiner, who points out that the control of insect pests must be based on the ability of the horticulturists to recognise and identify the particular pests attacking their orchards. The author gives a table figuring various stages of the chief orchard pests and details the work to be undertaken in orchards according to the season of the year. He also describes various insecticides, fungicides, sprayers, etc.

GORIAINOV (A.). **Засыханiе и бѣлоколоссость злаковъ.** [The withering and white ears of grain.]—**«Вѣстникъ Рязанскаго Губернскаго Земства.»** [*The Messenger of the Zemstvo of the Government of Riazan*], *Riazan*, 1914, no. 11–12, pp. 69–77.

A popular account is given of the causes producing the withering of ears of grain, which may be due to the weather or to various insect pests. The larvae of the sawfly, *Cephus pygmaeus*, devour the walls and knots of the stems of grain and remain in the stubbles over the winter. The ploughing of the stubbles in autumn or burning them is therefore a very effective remedy. Similar injury is done by Elaterid larvae. The most usual remedy is poisoned bait, while mineral manures have also given favourable results. *Mayetiola* (*Cecidomyia*) *destructor* can also be successfully combated by reploughing the stubbles. Sometimes only one ear with its stem withers, while the remaining parts of the plant remain healthy. This is caused by the larva of a moth, *Ochsenheimeria taurella*, against which no effective remedies are known, though trap crops is recommended. A mite, *Pediculopsis graminum*, L., causes the distortion of the ears, and similar injury is done by the larvae of *Oscinella* (*Oscinis*) *frit*, and by aphids and various species of thrips.

Ainslie (G. G.). **The Larger Corn-Stalk Borer.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 634, 7th December 1914, 8 pp., 4 figs.

Diatraea saccharalis, F., the well-known sugar-cane pest, does great damage to maize in the southern states under certain weather conditions. A heavy wind late in the season, before the maize is matured, breaks the plants off at the surface of the ground, mostly owing to the injury inflicted there by this larva, known as "the larger corn-stalk borer." Earlier in the season it attacks the young maize, producing rows of small circular or irregular holes across the blades. An account is given of the habits of the larva, and of the seasonal history of the insect, all stages of which are described. Besides maize and sugar-cane, it also attacks sorghum, Johnson grass, guinea corn, and grama grass, but the injury to the last four is never severe.

Howard (L. O.). **The Carpet Beetle or "Buffalo Moth."**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 626, 2nd December 1914, 4 pp. 1 fig.

In the Northern States, all the year round, but more frequently in summer and autumn, the active brown larva of *Anthrenus scrophulariae*, L., may be found in well-heated houses feeding upon carpets and woollen goods. It is originally a European insect, and was imported into the United States about 1874. *Anthrenus lepidus*, Le Conte, from the Pacific coast, is now believed to be a distinct species and does not attack carpets, so far as known. *A. scrophulariae* beetles begin to appear in autumn and continue to emerge, in heated houses, throughout the winter and the following spring. Under favourable conditions, the eggs hatch in a few days and the larvae develop rapidly if food is abundant. Cold weather or lack of food retard development for an almost indefinite period, particularly in a dry atmosphere, the larvae moulting frequently and feeding upon their cast skins. Under normal conditions the skin is cast about six times, and there are probably in the North not more than two generations annually. The yellowish pupa is formed inside the last larval skin. The beetles are day-flyers and are attracted to light when not engaged in oviposition. These Dermestids are strongly attracted by various plants, particularly of the family Scrophulariaceae, certain Compositae, such as milfoil, and the flowers of *Spiraea*. Under ordinary circumstances, it is probable that migration from the house takes place after oviposition. In Europe the insect is not especially noted as a household pest, The carpet habit is a bad one from other points of view and as carpets become more and more discarded in the Northern States, the "Buffalo bug" will eventually cease to be an important household pest. In Europe this species is a museum pest, but has not acquired this habit to any great extent in the United States. Where it does occur, it has been imported from Europe in insect collections. Only the most thorough and long-continued measures will eradicate it once it has taken possession of a house. Carpets should be very thoroughly beaten, sprayed out of doors with benzine, and allowed to air for several hours. In rooms, kerosene or benzine should be poured into the cracks and sprayed under the base-boards. Wide cracks may be filled with liquid plaster of Paris. Before relaying carpets, tarred

roofing paper should be laid upon the floor, at least around the edges. The edges of the carpet should be lifted occasionally and examined for the presence of the insect. Later in the season, if the insect has made its appearance, it may be killed by laying a damp cloth on that particular part of the carpet and ironing it with a hot iron. The steam thus generated will pass through the carpet and kill the insects immediately beneath it. Fumigation with bisulphide of carbon is an effective remedy against *A. scrophulariae*, and hydrocyanic acid gas is even more effectual. The fumes of burning sulphur will also kill it if the fumigation is thorough. A general adoption of rugs or squares of carpet, which may be readily examined and treated, will permit of the pest being dealt with without delay.

URBAHNS (T. D.). **The chalcis-fly in alfalfa seed.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 636, 31st December 1914. 10 pp., 10 figs.

Bruchophagus funebris, How. (the clover-seed chalcis-fly), generally called the alfalfa-seed chalcis-fly in the United States, has been increasing very rapidly there, causing a large annual loss and even threatening the production of lucerne seed in some localities [see this *Review*, Ser. A, i, p. 180]. The eggs of this insect are so small as to be invisible to the naked eye, and are deposited through the soft green seed-pods directly into the seeds. Under field conditions, oviposition usually takes place when the pods are about half grown. The time required for the eggs to hatch varies greatly. Under favourable temperatures, the larvae begin feeding in about a week after the eggs have been deposited. They feed within the tender growing seeds, and before the pods have had time to ripen, most of them are full-grown. When there is sufficient moisture remaining in the seed-pods, most of the larvae at once transform to the pupal stage, but if the seeds become thoroughly dry before the larvae enter the pupal stage, this transformation may be delayed indefinitely and the larvae remain dormant until the following spring or until both moisture and temperature are favourable. The pupal stage may last from 10 to 40 days, all the stages of development being completed within the infested seeds. The adults immediately eat their way out through the shells of the infested seeds and then through the seed-pods. They may be seen in great numbers when the crop is being cut and are often taken for gnats. Although most active in hot weather, the adults seek shade in the heat of the day. They apparently visit the lucerne blossoms to seek food, and in normal weather live several weeks. Hibernation takes place in the larval stage. By far the greater number may be found in the seeds on neglected fields and along fences and ditch banks. Screenings around the lucerne straw stacks and the seed of *Medicago hispida* (bur clover) conceal many of the larvae. The insect probably occurs throughout the United States; injury from it has been observed in cultivated lucerne seed from Germany, Turkestan and Chile, and in both the cultivated and uncultivated varieties of seed from Turkey and Siberia. The injury is entirely confined to clover, bur clover, and lucerne. The infested seeds which still contain the living larvae may

be recognised by their abnormal shape and usually by their dull brown colour. Those which retain their natural colour always lack the glossy appearance of normal seeds. The extent of injury is not generally apparent and in order to obtain an estimate of the percentage destroyed it is necessary to open a large number of the pods and to count the infested seeds. Observations show that the early emerging adults crowd to the first seed-pods in large numbers, resulting in a heavy infestation. These first pods are, however, nearly always found on the isolated plants growing on fence lines and ditch banks. In localities where bur clover is abundant, the pods of these plants receive the early infestation. When the lucerne pods develop in large numbers on the early seed fields there is apparently a decrease in the percentage of infested seed, and from this time on a gradually increased infestation follows until the close of the season. The pest destroys from 10 to 30 per cent. of the seeds in the early crops and from 20 to 70 per cent. in the late ones. In the autumn of 1912, an investigation was started with a view to determining some practical method of checking this pest, and though much of the work is still in an experimental stage, certain practices are available whereby the numbers may be reduced in the lucerne fields. In the case of a very severely infested field, the custom of driving in cattle to pasture is a great mistake, as many of the pods are burst open, while others are trampled to the ground, producing conditions favourable to the hibernation of the larvae from which adults will emerge and infest the seed crop in the following spring. The crop should be mowed, removed from the field, and stacked. It may then be used as rough fodder, and if the remaining straw is burned in early spring, the hibernating larvae will be destroyed. It is most important that the lucerne along ditch banks and fence lines should be cut and this should be done with the harvesting of each hay crop, before the seed crop is grown. Where land is enclosed between two parallel ditches, it is economical to fence them and use the land as a summer pasture, thus preventing the growth of the pods and the development of their parasites. In harvesting the seed crop, many infested pods drop to the ground and a thorough cultivation with a lucerne cultivator, either late in autumn or early in winter, will cover such pods sufficiently to prevent the emergence of the adults when the warm spring weather arrives. After the lucerne is threshed, the chaff and the screenings should be placed in a compost pile for three or four months so that it may become heated and decayed, most of the insect life being destroyed. Unless this treatment is carried out, the screenings should be burned before the growing season opens in spring. In the autumn or early spring many pods along check ridges and fence lines may be destroyed by burning off the weeds and lucerne. Only seed that has been well cleaned after threshing should be planted ; the uncleaned product should never be planted in new fields, as it not only gives poor results, but also gives the pest a start. The seed crop should be so handled that the setting of the pods will be as uniform as possible, and the crop should then be harvested as soon as the larger number of pods are ripe. Where the crop is allowed to remain on the field for a lengthy period in order that all the green pods may develop, ripe, half-grown, and newly formed pods occur together on the same plant. Many individuals infesting the earlier pods thus have time to complete their development and after emerging, deposit their eggs

in the green pods growing on the same plant upon which they themselves were bred. In midsummer, most of the adults emerge within three or four weeks after the crop is harvested. Where later seed crops are grown, it is therefore advisable to stack the early crops as soon as possible, thus preventing the free emergence offered by leaving the crop in shocks on the field. Where bur clover is abundant and matures its seed-pods in early spring, they should be destroyed by burning the fence lines in the spring. This can frequently be done after the plants mature and before the lucerne seed crop comes on. This paper concludes by pointing out that organised effort is required if *Bruchophagus funebris* is to be efficiently controlled.

PARKER (W. B.). **Quassiin as a Contact Insecticide.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 165, 31st December 1914, 8 pp., 1 fig, 2 tables.

From investigations in California, the writer believes that quassiin could be cheaply prepared and possibly sold at a lower price than some of the materials now on the market. Quassia chips, commonly used in preparing spray solutions for the control of the hop aphis, *Phorodon humuli*, Schr., are the wood of *Picrasma excelsa*, Swz., the Jamaica quassia, which is stated to be available in considerable quantities. To determine the insecticidal value of quassiin, its action was compared with that of nicotine sulphate of a known strength. Soap bark solution had to be used instead of whale-oil soap as the spreader, since the latter killed some of the aphids. Prune twigs infested by *P. humuli* and *Hyalopterus pruni*, F., and set in moist sand were sprayed with a compressed air spray machine; the insects that were killed were readily obtained from this and counted. The table of results given shows that quassiin used at the rate of $6\frac{1}{2}$ oz. of 40 per cent. solution to 100 U.S. gals. was almost as effective as nicotine sulphate, $6\frac{1}{2}$ oz. to 100 U.S. gals. The percentage of quassiin in quassia wood varies; supposing it to be 0·75 per cent. only, $1\frac{1}{2}$ lb. of chips would be needed for 100 U.S. gals. of spray; if, for safety, 3 lb. be used and 3 lb. whale-oil soap, the total cost of materials per 100 U.S. gals. is 1 shilling. Allen's method for extracting quassiin was used in its preparation for the experiments and is as follows:—Quassia wood is exhausted with hot water and the liquid precipitated with neutral lead acetate. Sulphuretted hydrogen is then passed through it to remove excess of lead, and after filtration the solution is shaken up with chloroform, which dissolves out the quassiin and may be removed by decantation. On evaporating the chloroform, the quassiin is obtained in a more or less crystalline condition. It is readily soluble in alcohol, and when the alcoholic solution is boiled, a precipitate forms, which was filtered off and the filtrate evaporated to dryness on a water bath, the resulting dark resinous material being extracted with boiling water. When cool, this was again extracted with chloroform, evaporated down and made into solutions of standard strength. Even when diluted to 1 part in 5,000, it was effective as an insecticide. It seems probable that an impure form of quassiin, soluble in water, could be prepared by extracting it from the wood with a solution of sodium carbonate, more cheaply than by Allen's method.

FEYTAUD (J.). **La Mouche du Céleri** (*Acidia heraclei*, **Linné**). [The celery fly (*Acidia heraclei*, L.)].—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xiii, no. 7, July 1914, pp. 109–114, 2 figs. [Received 8th March 1915.]

In recent years, complaints have been received from the south-west of France of the damage done to celery leaves by the celery fly, *Acidia* (*Trypeta*) *heraclei*, L. The eggs are laid singly on the surface of the leaves, in which the larvae mine. In England, pupation takes place in the soil, whereas in France and in the United States this stage usually occurs on the leaf. In the south of France, the winter is usually passed in the adult stage and two generations occur annually, the first from May to July and the second from September to October. This fly is also found on wild *Apium graveolens* and on various other Umbelliferae, such as *Heracleum sphondilium*, *H. longifolium*, *H. asperum*, *Angelica silvestris* and *Pastinaca sativa*, and on a Composite, *Onopordon acanthium*. Small insectivorous birds are among the natural enemies of the fly, which is parasitised by the Braconids, *Alysia apii*, *Sigalphus flavipalpis* and *Aspilota fuscicornis*, and the Chalcidoid, *Pachylarthrus smaragdinus*. To prevent oviposition on the celery leaves, a mixture of 3 parts soot and 1 part lime is recommended for dusting on the leaves, whilst in America, spraying with petroleum emulsions is used for the same purpose. The presence of wild food-plants in the vicinity naturally constitutes a danger to celery beds. Where these are of limited extent, the larvae may be killed by pinching the swellings on the infested leaves or by cutting them off and destroying them. A bibliography of 7 works is given.

ROBERT (J.). **Les Ephippigères nuisibles à la Vigne.** [*Ephippiger* spp. injurious to the vine.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xiii, no. 7, July 1914, pp. 114–116, 1 fig. [Received 8th March 1915.]

The grasshoppers belonging to the genus *Ephippiger* are omnivorous, Valéry Mayet recording them as even attacking labourers asleep in the fields, and they sometimes devour one another. The two species chiefly injurious to the vine are *Ephippiger ephippiger* (*vitium*) and *E. bitterensis*. The former occurs both in southern and central France, and the latter is chiefly prevalent in Languedoc. Each female deposits about 50 eggs in the soil during summer, the larvae hatch out in spring, and the adults appear in July. Very serious injury may be done to the vine if these Orthoptera are present in numbers. They attack the leaves, the bark of the branches and even the grapes. They infest cereals, and a field situated near a vineyard is a menace to the latter, for the harvest deprives the insects of their food and they migrate to the vines. Spraying with nicotine or aloes, or dusting with nicotined or naphthalined sulphur may drive the pests away, but the effect is usually temporary. The best method of control is hand-picking, either on the vines or on bait traps, such as offal. About 20 centimes ($1\frac{3}{4}$d.) is usually paid per kilo (2·2 lb.) to the women and children entrusted with the work.

PAILLOT (A.). **La Mouche du Chou et la Mouche de l'Oignon.** [The cabbage fly and the onion fly.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xiii, no. 8, August 1914, pp. 130-132, 1 fig. [Received 8th March 1915.]

The main portion of this paper has already been abstracted [see this *Review*, Ser. A, iii, p. 1]. As *Chortophila brassicae* also feeds on certain wild Cruciferae, especially *Barbarea praecox* [winter rocket], black mustard, and *Capsella bursa-pastoris* [shepherd's purse], such plants should be destroyed, at least in the vicinity of cabbage fields. Many of the pupae hibernate close to the roots of the cabbage and the as yet untransformed larva will be killed if the roots are torn up and destroyed, while rather deep ploughing in spring will bury the pupae. To prevent serious damage to onions by *Hylemyia antiqua*, planting should be deferred until about the end of April. The adult flies, which appear rather early, will then lack plants on which to deposit their eggs. An early-planted trap crop will attract most of them and it should be destroyed on the appearance of the first larvae. Crop rotation is indispensable. Preventive measures include the use of tarred paper disks and of chemicals. The soil may be watered with an emulsion prepared as follows: 2 lb. of black soap is dissolved in 7 pints of boiling water; when cool, 1 lb. of crude phenic acid should be added and the mixture stirred until it emulsifies; for use, 1 part of the emulsion is added to 30 parts of water. Several applications are necessary; the first when the young plants appear—in the case of the onion—and when the young plants have just been moved—in the case of the cabbage. The second application must be made 4 or 5 days later and subsequent ones at intervals of a week. Another method consists of covering the ground with a thick milk of lime (obtained by slaking quicklime with a sufficient quantity of water and adding about a spoonful of phenic acid to every 2 quarts of the fluid) which forms a protective crust. Carbon bisulphide injections are only useful in the case of cabbage and cauliflower beds. Potassium sulphocarbonate is a useful substitute for carbon bisulphide.

FEYTAUD (J.). **Sur la mortalité des Eudémis pendant l'hiver.** [The winter mortality of *Polychrosis botrana.*] -*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xiii, no. 12, December 1914, pp. 189-196, [Received 8th March 1915.]

Many eggs of *Polychrosis botrana* abort in spring owing to the difference between the date of oviposition and that on which the vine inflorescences are in favourable condition, many are killed by the great summer heats before they mature, whilst others are destroyed by chemical sprays. The excessive heat and dryness of some summers kill the larvae, the pupae and even the adults. Abnormal temperature in February and March hastens the hatching out of the winter pupae and the resultant adults die without progeny. The cold spells of spring and autumn retard the development of the insects and hinder oviposition. Humidity is of considerable importance in fostering bacterial and fungous diseases, such as those due to *Beauveria* and *Spicaria*. These are particularly contagious in autumn, as humidity is more constant at that season and also because the

autumn generation remains longer than the others in the pupal stage. The control exercised by animals, birds, and insects, predaceous and parasitic, is very considerable. All these factors attain their maximum importance during the last generation of the year which hibernates on the stocks as pupae. In March 1914, the author examined 1,003 cocoons taken in 5 different localities in the department of Gironde. The total mortality ranged from 75 to 93 per cent. Fungus diseases killed from 36 to 59 per cent., ichneumons from 13 to 36, predators from 1 to 20, and various causes from 3 to 8. Cold does not affect either *Clysia* or *Polychrosis*, owing to their method of hibernation, but it kills their insect enemies and the small percentages shown in the foregoing figures under this head are explained by the severe weather in January 1914. In summer, physical factors are more important; while in winter, when the mortality is highest, biological factors are more in evidence.

Osmaston (B. B.). **Larch Killed by a Longicorn Beetle.**—*Qtrly. Jl. Forestry, London*, viii, no. 4, October 1914, pp. 277–279, 3 figs. [Received 16th March 1915.]

Damage in larch woods by *Tetropium gabrieli* var. *crawshayi* has been observed in localities in North Staffordshire, Berkshire, and Sussex. Eggs are laid in June in crevices in the bark of sickly larch trees of about 6 inches diameter or more. The larvae hatch out in about a fortnight, feed through July and August, and devour the soft bast and cambium layers, penetrating 2 inches or so into the wood prior to pupation; the larva passes the winter in the pupal cell, usually excavated in the wood, until early April, when it pupates, and the perfect beetle emerges in May. Healthy trees do not appear to be attacked by this insect, but those which for any reason are in a sickly condition are quickly killed; some damage may be done to the outer layers of the wood, but chiefly the sapwood is damaged. In England, where, as a rule, larch woods contain numbers of trees weakened by attacks of canker [*Dasyscypha calycina*, Fuckl.] and by larch aphis [*Chermes laricis*, Hartig], this beetle enjoys very favourable conditions, and it would not be surprising if it should become a pest of some importance.

Larch plantations should, so far as possible, be cleared of all unhealthy trees. As soon as a tree is attacked, as indicated in summer by wilting foliage, and confirmed by finding larvae at work under the bark, the tree should be at once felled and converted or barked, the slabs or bark being burnt. If there are any green woodpeckers in the neighbourhood, the attacked trees will frequently be first recognised by the pitted bark, and it is evident that, by devouring the grubs, this bird is of the greatest service in controlling the beetle. For new larch plantations, it is recommended that planting should be restricted to localities where the larch is known to thrive; that pure plantations of larch, which introduce unnatural conditions, and over-crowding in the pole stage, be avoided.

McCallum (J.). **Large Larch Sawfly** [Correspondence.]—*Qtrly. Jl. Forestry, London*, viii, no. 4, October 1914, p. 333. [Received 16th March 1915.]

Lygaeonematus (*Nematus*) *erichsoni* (larch sawfly) still seems to be spreading throughout England, and is here, reported from Dorset. It is important to ascertain how it reached that locality, as it has not been previously recorded in the south of England.

Trägårdh (I.). **Försök med svavelkalkvätska mot lärkträdsmalen.** [Experiments with lime-sulphur spray against the larch moth (*Coleophora laricella*, Hb.).]—*Centralanst. för Jordbruksförsök, Flygblad no. 49, Stockholm*, Entom. Avd. no. 11, 1914, 3 pp.

The splendid results obtained by G. W. Herrick (*Cornell Univ. Agric. Expt. Sta.*, Bull. no. 322) against the larch moth with lime-sulphur spray, 29 Bé., 1 part to 7 parts of water [or at 33° Bé., 1 part to $8\frac{1}{4}$ parts, see this *Review*, Ser. A, i, p. 64] induced the author to test it against the same insect in the vicinity of Stockholm, where it had been attacking the larch trees for several years. The trees were sprayed in the middle of April, immediately before the buds burst. In the middle of June, when the larvae had finished feeding, the trees were examined, and the difference between the sprayed and unsprayed trees was very conspicuous even at a distance. The examination of the needles showed that in the unsprayed trees about 67 per cent. of them were destroyed, while in the sprayed only 13 per cent. were attacked. As on the latter trees only branches were examined which showed any damage at all, the figure given is higher than the true percentage. The following year the experiments were repeated. In order to ascertain the intensity of the attack the number of winter cases per 100 buds was counted. It proved to be 27, 41 and 74 respectively in the trees to be sprayed. The spraying was done a little later than in the previous year, on the 24th April, the buds measuring about 4 mm., and many larvae had left their hibernating quarters and started mining the needles. The spray was diluted with 20 parts of water. The examination on the 16th May showed that in the sprayed trees only 0·24 per cent. of the needles were attacked, in the unsprayed 50–60 per cent. The experiments thus wholly confirmed the results obtained by Herrick, showing that lime-sulphur spray is an excellent remedy against the larch moth.

Headlee (T. J.). **Report of the Entomologist.**—*Rept. New Jersey Agric. Expt. Sta., 1913, New Brunswick*, 1914, pp. 631–698, 2 plates. [Received 8th March 1915.]

In New Jersey, the late, cold spring of 1913 was especially favourable to the development of Aphids, as plenty of food was available and the temperature was too low for their hymenopterous parasites to thrive. *Phylloxera caryae-avellana*, Riley, *P. caryae-caulis*, Fitch, and *P. caryae-phallax*, Walsh, were reported as making galls on hickory, and grape leaves suffered similarly from *P. vastatrix*, Planch. Maple foliage was badly infested in many cases with *Pemphigus*

acerifolii, Riley, and *P. aceris*, L.; tulip-trees also suffered. *Lachnus abietis*, Fitch, (the spruce gall louse) was abundant. The chief aphid pest of apple orchards was *Aphis pomi*, de G. (*mali*, F.), but wherever the lime-sulphur spray for San José scale was applied while the buds were swelling, the aphids were destroyed; if, however, spraying was delayed until the buds opened sufficiently for the aphids to crawl inside them, they were not satisfactorily controlled. Forty per cent. nicotine solution applied between the opening of the leaf buds and the opening of the flower buds (*i.e.*, the "cluster-cup stage") at the rate of one part to 500 parts of water, to which soap is added at the rate of 4 lb. to each 50 U.S. (41½ Impl.) gallons, would in all probability serve to protect orchards in which the dormant spray either was not given at all, or given at such a time that it failed to kill the lice. It has been shown that Black leaf 40 can be used safely and efficiently with "Pyrox." Experiments during the spring and summer showed that this tobacco mixture could be used in either Bordeaux or lime-sulphur summer spray mixtures without damage to foliage or fruit. It has been found to be efficient for apple aphids at the rate of one part to 650 parts of the diluted spray. *Schizoneura lanigera*, Hausm., was a little more abundant than usual, especially on the above-ground parts of apple-trees. Peach trees were infested to a considerable extent by *Myzus persicae*, Sulz., and *Aphis persicae-niger*, E.S., while in some cases cherry trees suffered severely from *Myzus cerasi*, F., and plum trees from *Hyalopterus arundinis*, F. *Aphis gossypii*, Glov., was very abundant and did much damage, especially to melons; thorough spraying with a combination of nicotine sulphate and soap will protect the plants, and it is probable that one part of 40 per cent. nicotine solution to 45 parts of water, with whale-oil or laundry soap added at the rate of 4 lb. to each 50 U.S. gallons will prove a satisfactory mixture; early treatment is essential [see this *Review*, Ser. A, iii, p. 163]. *Aphis forbesi*, Weed, *A. brassicae*, L., and *Rhopalosiphum solani*, Thos., slightly damaged strawberries, cabbages, and tomatoes respectively. *Myzus ribis*, L. (currant aphis) and *Nectarophora rosae*, L., were also reported.

During the summer, natural enemies of the San José scale were very abundant, and in northern New Jersey practically every peach tree had a dozen or more of the lady bird beetle, *Microweisia* (*Smilia*) *misella*, Lec., on it; *Prospaltella aurantii*, How., *Aphelinus fuscipennis*, How., and *Signiphora nigrita*, Ashm., were also collected in various parts of the State. For a period of several years the San José scale appears to have been declining, and this is probably due to better artificial treatment, combined with the work of its natural enemies. The author disagrees with the recommendation of the Economic Zoologist of Pennsylvania to disseminate *A. fuscipennis* and *Anaphes gracilis*, How., artificially, as these species are already widely distributed, and introduction would not only be waste of time and money, but through engendering neglect of tried and efficient measures, would entail heavy financial loss. *Eulecanium nigrofasciatum*, Perg. (terrapin scale, or peach Lecanium) was fairly abundant, but soluble oil gave entirely satisfactory results. *Chionaspis furfura* Fitch (scurfy scale), *C. pinifoliae*, Fitch (pine leaf scale), *Lepidosaphes ulmi*, L. (oyster-shell scale), and *Aulacaspis rosae*, Bché. (rose scale) gave the usual amount of trouble.

Although it is not known how widely *Lygidea mendax*, Reut. (false apple red bug) is distributed in New Jersey, it is a very serious menace to apple production there. A brief statement as to life-history and control taken from C. R. Crosby [*Cornell Univ. Agric. Expt. Sta.*, Bull. 291 (1911)] is given, and it is noted that *Heterocorydalis malinus*, Reut., which usually accompanies *L. mendax*, has not yet been taken in New Jersey.

Leptobyrsa explanata, Heid. (the rhododendron lace-bug) gave some trouble. According to E. L. Dickerson, this species is found on the under side of the leaves of both rhododendron and mountain laurel, where it lays its eggs *in* the leaf tissue along the mid-rib; it is in this stage that the winter is passed. Hatching begins in New Jersey in early May, sometimes a little earlier, the insects becoming fully developed in about a month, and it is believed that later in the season there is another brood. Infested plants should be sprayed in May, the younger the insects the more effective will be the spraying; 1 lb. whale-oil soap to 4 lb. U.S. ($3\frac{1}{3}$ Impl.) gallons of water is satisfactory, but the under sides of the leaves must be reached.

Extensive damage was done to cranberries, and this was found to be due to the cranberry katydid and not to the grasshoppers and crickets found on the bogs. Few complaints of injury from white-grubs were received, and damage by *Galerucella luteola*, Mull. (elm-leaf beetle) was comparatively slight. *Epitrix cucumeris*, Harr. (potato flea-beetle) was the worst insect enemy of the potato, and besides consuming the leaf, this species transfers blight; plants well covered with Bordeaux mixture are not seriously injured and this will, besides controlling the adult above ground, indirectly prevent injury to the tubers by the grubs. Two reports of threatened destruction of potato plots by the blister beetle, *Epicauta vittata*, F., were received, but in both cases arsenical poisons prevented destruction. *Macrodactylus subspinosus*, F. (rose beetle) appeared in considerable numbers on grape foliage, but was promptly checked with arsenate of lead and glucose spray (5 lb. lead and 12 lb. glucose to 50 U.S. ($41\frac{1}{2}$ Impl.) gallons of water). *Conotrachelus nenuphar*, Hbst. (plum curculio) seems to be holding its own, but a fairly satisfactory control can be obtained by the use of arsenicals. *Scolytus rugulosus*, Ratz. (fruit-tree bark-beetle), attracted much attention by its work on peach, but the attacked trees, under proper cultivation, pruning and spraying, may recover and bear much fruit. In certain parts of New Jersey, *S. quadrispinosus*, Say (hickory bark-beetle) is almost as serious a pest of hickory as the chestnut-bark disease is of chestnut, and as yet no really satisfactory control measures have been found. *Chloridea* (*Heliothis*) *obsoleta*, F. (corn-ear worm) was very abundant, infesting nearly 100 per cent. of all sweet maize ears in late summer and early autumn; a full account of this insect forms a special part of this report. Cutworms were frequently reported, but poisoned bran mash proved a specific against them. *Thyridopteryx ephemeraeformis*, Steph., again attracted attention, but this bag-worm is so well understood that it should not be allowed to do serious harm. *Zeuzera pyrina*, L., (leopard moth) seems to have remained stationary, nor has the position in respect of *Cydia pomonella*, L. (codling moth) undergone any important change. *Melittia satyriniformis*, Hb. (squash-vine borer) attracted much attention, but cutting out the borers has been practised with satisfactory results.

Without doubt the worst insect attacking peach is *Aegeria* (*Sanninoidea*) *exitiosa*, Say (peach borer) and growers are greatly desirous of a better method of control than that found in the practice of "boring"; thorough tests of various substances, particularly asphaltum, are being carried out, but nothing better can yet be recommended; a special section of this report is devoted to these investigations. Ripe grapes in some parts of the State were badly injured by wasps and hornets. *Vespa crabro*, L., was found cutting open and feeding on the flesh of seckel pears, and attacking apples after the pears were harvested. Grapes thus attacked should be bagged with a paper sack to each bunch, and the nests of the wasp sought out and destroyed.

Insects of special interest, either because new to New Jersey records or because of the danger of their introduction, dealt with in this report include an undetermined Buprestid borer in *Rosa rugosa* nursery stock; *Hylurgus* (*Myelophilus*) *piniperda*, L. (the pine beetle); a sawfly, *Kaliosysphinga dohrnii*, Tischb., on alders; and a few notes on brown-tail and gypsy moths. Extensive details of orchard, potato, and maize dusting (with numerous tables) conclude this section of the report.

SCHOEVERS (T. A. C.). **Een rupsenplaag in de aardbeiplanten in de omgeving van Beverwijk.** [A caterpillar plague in the strawberry grounds near Beverwijk.]—*Tijdschr. Plantenziekten, Wageningen*, xx, no. 4, December 1914, pp. 97–106.

For many years past the strawberry fields in the district about 10 miles north of Haarlem, have been seriously damaged by caterpillars and in the spring of 1914 complaints were sent to the Institute of Phytopathology at Wageningen. On account of the very great importance of the industry in these parts, it was decided to conduct an investigation into the matter. As far back as 1906, caterpillars had been received from Beverwijk which proved to be those of *Sparganothis* (*Oenophthira*) *pilleriana*, Schiff., but it was by no means certain that the same pest had done the damage year after year since that time. It was found that the strawberries planted in the summer of the previous year suffered little or no damage, but that in the second and third year it was very serious. The caterpillars begin by attacking the leaves, which soon become bound together by a web; these operations are plainly visible about the middle of May. About this time the plants come into bloom and both buds and flowers are devoured, one-half or even two-thirds of the first blooms being destroyed. The later blooms do not suffer quite so much. It was observed that one grower who made a point of clearing the ground of all dried leaves and rubbish during the winter suffered but little, whilst another who left everything on the ground lost more than three times as much. Two kinds of caterpillars were found, both belonging to the TORTRICIDAE. These were bred and the imagines were identified as *Olethreutes urticana*, Hb., and *O. rooana*, De Graaf, while another lot of green caterpillars yielded what, according to A. Brants, were *Oxygrapha* (*Acalla*) *schalleriana*, L.; no *S. pilleriana* were obtained. No data could be found in the literature on the subject as to the hibernating stage of *Olethreutes*, but it is probable that it winters either as a young caterpillar

or in the egg stage. According to Snellen and Barrett, *O. rooana* is a variety of *O. lacunana*, Schiff. It is thus more or less clear that four species of leaf-rollers attack strawberries. It is at least probable that, whether as caterpillar or egg, the two species of *Olethreutes* pass the winter above ground on the plants, and it would therefore appear advisable to clean the beds thoroughly of all rubbish and dead leaves and also to remove all withered and damaged leaves from the plants. In this way the majority of the eggs and larvae would be removed. The case of the strawberry field which, though well cleaned, still suffered somewhat, points to *O. schalleriana* as the probable cause, as these moths can find better shelter elsewhere than between the strawberry plants, though still near to the beds, when they are driven away by the removal of the rubbish. Some additional means of destroying the insects being thus necessary, poisoning the leaves with lead arsenate or Paris green suggested itself, but under the conditions, it is very difficult to make the poison reach the larvae. A stream sprayer was used which forcibly projected the solution in drops of some size ; solutions of $\frac{1}{2}$ per cent. lead arsenate and one-tenth per cent. Paris green in lime-water were used on a badly infested plot. It failed to penetrate the webs satisfactorily and a further attempt made later was also unsuccessful. To be of any use, such spraying must therefore be done earlier, before the webs are formed or at least before they have any consistency. The time will depend largely on the weather and on the district in question. The early days of April appear to be the best time, so that the first food of the caterpillars may be poisoned ; in any case before or about this date the beds should be most carefully examined for any trace of attack and action taken accordingly. The eggs are flat and oyster-shaped and are generally laid in groups, being covered with a kind of varnish ; the species of *Olethreutes* probably lay their eggs singly.

RITZEMA BOS (J.). **Eene Belangrijke Vreterij van de Beuken-Borstelrups of den Roodstaart** (*Dasychira pudibunda*, **L.**) **in het Elspeter Bosch.** [Serious defoliation by the beech bark caterpillar or red tail (*Dasychira pudibunda*, L.) in the wood at Elspeet.] *Tijdschr. Plantenziekten*, *Wageningen*, xx, pt. 4, December 1914, pp. 115–140.

In October 1914, about 125 acres of the beech woods at Elspeet were completely defoliated by *Dasychira* (*Orgyia*) *pudibunda*, L. A few oaks scattered among the beeches were also practically stripped, as was the undergrowth, which appears to have provided food for the swarming caterpillars, when the beech leaves had been consumed. The buds were not greatly damaged, but a great quantity of one-year-old twigs were found to be dead. The imago is on the wing at the end of May and beginning of June and the eggs are laid on the trunks of the beech in masses varying in number from 50 to 400, which have a bluish-grey tint and are quite smooth and not covered with hairs, as is the case in many allied species.

A detailed account of the distribution of this pest is given, and it is stated that the island of Rügen is notorious for its ravages. The eggs are generally laid at from 6 to 10 feet up the trunks of the trees, but when the invasion is very serious they will be found 12 to 18 feet above the ground. The caterpillars, which are described in

detail, occur from July to the third week in October, when pupation generally takes place. The pupae are to be found on the ground attached to fallen leaves, low bushes and shrubs; sometimes, though rarely, on branches. On the Continent of Europe, this pest specially attacks beeches, though a long list is given of deciduous trees and shrubs which are attacked when beech leaves are wanting. The caterpillars have even been known to attack fir, larch and pine, while ash and alder are apparently distasteful. Failure of food hastens the date of pupation and reduces the size of the imago.

The caterpillars of *D. pudibunda* are greatly influenced by cold, wet weather, and in some years large numbers are thus killed; many fall victims to early night frosts, so that out of the three or four hundred eggs laid by each female, the number of the surviving caterpillars rarely amounts to a plague; this only occurs when the weather conditions in late summer are favourable. If the weather be for a time not only warm but damp, the mortality from bacterial and fungus diseases is very great. Numbers were found at Elspeet dead of "flacherie" on 6th October. Large numbers of the pupae are attacked by a fungus, *Isaria desa* or *Cordiceps militaris*, and the following parasitic Hymenoptera have been bred from them: the Ichneumons, *Pimpla instigator*, *P. pudibundae*, *Ichneumon hartigi*, *I. multicinctus*, and *Anomalon excavatum*, and the Proctotrupid, *Ceraphronal bipes*. The eggs are also infested by the larvae of the Scelionid, *Telenomus truncatus*, Nees, (*Teleas zetterstedti*, Ratz.). These parasites, as well as the fungi, generally make their appearance in force when the caterpillars are very numerous. Various predaceous animals also greatly reduce the numbers; the eggs are devoured by nuthatches, tits and other birds; cuckoos, jays and tits eat the caterpillars; and the pupae are devoured in winter by crows, rooks, magpies and tits, and also by bark-beetles, and even wild pigs are to be regarded as useful in consuming the pupae of *Dasychira* and other Lepidoptera. The damage done by the caterpillars is not so great as might be expected from their enormous numbers. The first signs of defoliation are generally visible in the second half of July and in August, that is to say, at a time when the leaves have already to a large extent performed their functions, so that the growth is not greatly interfered with. The attack comes so late that the buds formed in the same year, even on thoroughly defoliated trees, often open and the effect is thus different from that resulting from the attacks of *Melolontha*, *Lymantria dispar*, *Euproctis chrysorrhoea*, *Malacosoma neustria*, etc. It has been observed that when a beech has been defoliated by *Dasychira*, the buds open about eight days earlier in the following spring; the foliage is however less and the amount of beech mast produced is very small. When one attack follows another for two or three years in succession, the beeches suffer seriously in their growth and the whole of the crown of a tree may die. The total defoliation of the trees causes a loss of vegetable manure to the soil below, though the excrement of the caterpillars often forms a layer on the ground and encourages a growth of grass which may last two or three years, and this is especially injurious in nurseries of one or two year old trees. The hairs of the caterpillars are carried by the wind and cause great annoyance and itching to human beings, and produce lung and liver troubles in cattle, sometimes causing death.

The control of this pest is difficult and the cost often greater than the value of the material saved. A careful distinction is drawn between general control and the combating of a serious outbreak. If an outbreak occurs in an isolated plantation and it appears probable from its severity that it will last two or three years, it is best to leave the parasites and natural enemies to do their work, for it seems to be a proven fact that three years is the limit of continued attack. If the beech wood be very large and the defoliation serious, the cost of control is too great, and before it is undertaken, the possibility of obtaining sufficient labour must be considered, for half measures are utterly useless. It is often necessary to incur the expenditure on one wood or plantation in order to save others near by in the following year. Removal of the egg-masses is an important method of control. In German forests the workmen rub them off with the hafts of their mattocks ; the rounded trunks make this difficult to effect properly and many are simply knocked off and fall to the ground. Painting with oil was found more effective, and experiment showed that no properly oiled egg ever hatched. The maximum period during which the process can be carried out is three weeks and the trunks must be visited several times to make sure that all fresh egg-masses are oiled ; many may be out of reach or hidden from view, and though good, this method cannot be regarded as absolutely complete. Killing the caterpillars can be done by sweeping them off the trees at the time when they begin descending to pupate ; short-handled brooms or hard brushes are the best tools. As the caterpillars are very easily disturbed, hitting the trunks with wooden mallets will bring them down in thousands and they may be collected on rick cloths spread on the ground, or may be gathered up with the fallen leaves, though if there be much undergrowth, this plan is difficult to carry out. High-banding of the trunks with sticky material above the level at which the eggs are laid, prevents the caterpillars from reaching the foliage ; and low-banding, at a height of 4 or 5 feet above the ground, will catch any that try to descend and prevent others which may have dropped from the branches from recovering their position. Banding is unfortunately not so effective as might be supposed ; even careful banding at 16 feet above the ground has been found to leave eggs enough higher up to produce sufficient caterpillars to defoliate the tree. In any case the material used should be such as will remain tacky for two months, and care should be taken that all trees are banded without exception ; the cost of the material for 120 acres of beech wood is very considerable and proper high-banding is obviously an expensive operation, as ladders must be used. Trap and isolation trenches, 12-14 inches deep and 10-12 inches wide, with holes 5 or 6 inches deep at the bottom at intervals of 5 or 6 paces, are useful for preventing the caterpillars after defoliating one tree from travelling to another, or for preventing the invasion of a neighbouring plantation. Although the caterpillars do not, as a rule, travel far over the ground, except when driven by hunger, they can and do creep out of the trenches, and these must be therefore cleared daily. The collection of the pupae on the fallen leaves, &c., is probably one of the best methods of control, but these should not be destroyed at once, but so dealt with that the parasites may escape and multiply. Collection of the insects themselves is regarded as quite practicable

and useful, and can be done by children if paid for by weight, but as the object is to prevent the spread of the moths, the catching of them on the outer borders of woods and plantations should be done by trustworthy men on a daily wage. In the beech wood at Elspeet, it was estimated that 4 million caterpillars at least were collected from 6th to 28th October, at a cost of £8; nevertheless large numbers of pupae were found late in November.

RITZEMA BOS (J.). **Ziekten en beschadigingen veroorzaakt door Dieren: Insecta.** [Diseases and damage caused by animals: Insects.]—*Meded. R. Hoogere Land, Tuin en Boschbouwsch., Wagenigen*, vii, nos. 2 & 3, 1914, pp. 67–95.

Otiorrhynchus picipes, F., is reported as having damaged roses and the grafts of fruit trees. Grapes were also attacked, and it is noted that while the Frankenthaler variety suffered, Black Alicante in the same cold house was untouched. Beech and birch in nurseries at Oudenbosch were also damaged by this insect, the leading shoot of the young trees being specially attacked. It was found that great quantities of the beetles could be easily collected at night from a large raspberry plot with a lantern and an open umbrella. Sticky belts are recommended to prevent the beetles from climbing the trees. *Cneorrhinus geminatus*, F., damaged peas, rhubarb and budded roses; the same methods of control are recommended as for *Otiorrhynchus*. *Sitones lineatus* did great damage to beans. *Melolontha melolontha* (*vulgaris*) killed large numbers of *Lathyrus* (everlasting pea); holes about 4 inches deep and 5 or 6 inches apart, and not too close to the roots, should be made, filled with benzine, and closed at once. *Cossus cossus* (*ligniperda*) has done great damage to oaks at Diepenveen near Deventer. The worst attacked trees were felled and the bore-holes in others treated with carbon bisulphide or benzine, which it was hoped would also prevent the moths from ovipositing. Trees of about 6 feet in height were sprayed with 3 per cent. milk of lime, as the moths are more easily detected on the whitened trees and the lime appears to deter them from ovipositing. The caterpillars of *Hepialus lupulinus*, L., seriously attacked syringas, clematis and peonies in pots at Boskoop; a similar outbreak occurred at the same place in 1905. It was found by experiment that a minimum of 12 cc. of benzine was required, and the same quantity was necessary for the much smaller clematis pots, possibly owing to the more rapid escape of the benzine through the smaller quantity of earth; the plants did not suffer in the least. *Hydroecia micacea*, Esp., was bred from a caterpillar obtained from a "wormy" apple. The other food-plants of this species are strawberries, beetroot, potato stems, tomatoes (in England) and barley. Great numbers of *Bupalus piniarius*, L., appeared near Rhenen in the summer. The females, which fly in May and June, lay their eggs in groups in cracks on the underside of the needles of the previous year. The larvae hatch at the end of June and are full-grown in September, when they let themselves down to the earth by a silk thread and make a web covering for themselves under the fallen leaves on the soil, pupating about

January. As the feeding begins when the needles are fully grown and the buds of the next year formed, the damage done is generally not very great, and if the winter be hard, large numbers are killed. *Eucosma* (*Grapholita*) *ocellana*, Schiff., has done great damage in a pear-tree nursery. As this insect almost always passes the winter in the egg stage, spraying the trees in winter with 6 per cent. carbolineum is recommended, and from reports received the method is strikingly successful. *Laurus nobilis* and rhododendrons suffered greatly from leaf-miners which proved to be *Batodes* (*Capua*) *angustiorana*, Haw. This is a pest of apricots in the South of England, but is probably a South European moth, as it has not yet been found in Germany ; it is, as yet, an uncommon pest in Holland. It does more damage to laurel than to rhododendrons, first mining and then skeletonising the leaves, and may be checked by cutting off such leaves and burning them. In April, mined and rolled leaves of *Azalea indica* were sent to the station ; two moths bred from cocoons there were determined as a species of *Gracilaria*. In July and August other species of azalea received direct from Japan were found to be attacked in the same way and moths were bred from the caterpillars and proved to be *Gracilaria zachryoa*, Meyr. (*azaleëlla*, Brants). Spraying the leaves with insect powder in soapy water was found useful, but the dry powder had no effect. Paris green was not satisfactory ; the best plan is to cut off and burn the affected leaves. *Zophodia* (*Phycis*) *convolutella*, Hübn., has been found on black currants and gooseberries. The insects are on the wing in May and lay their eggs separately on the twigs ; the larvae feed till July and then pupate under the soil and hibernate there, though there is some evidence of hibernation as an imago. The damage done is not very serious, but requires control, and the best plan is to pluck and burn all damaged berries. In the case of gooseberries and black currants it is better to shake the twigs, as the larvae then drop on a silk thread and can be caught. Thorough stirring of the soil under the bushes in winter turns up the pupae, when poultry and birds can find them. Among hymenopterous pests, *Lophyrus rufus*, Klug, was reported to have stripped a large number of firs at Swalmen near Roermond. The larvae of this insect may be mistaken for those of *L. pyri*, L., which are more dangerous, as *L. rufus* has only one generation in the year. The damage done by species of *Lophyrus* is very characteristic ; until the larvae are half grown they eat the margins of the needles, leaving the midrib sticking out like a wire ; the older larvae eat the whole needle. The damage is confined to fir plantations and related varieties of *Pinus*, and generally the weaker and less vigorous trees are attacked in open, sunny situations. Spraying with lead arsenate and Paris green gives good results against the larvae ; raking and turning over the debris on the ground in winter exposes the cocoons and kills the hibernating larvae, and this is greatly assisted by the use of quicklime.

Dipterous pests included *Contarinia* (*Cecidomyia*) *tritici*, Kirby, and *Setodiplosis mosellana*, Gehin (*C. aurantiaca*, Wagn.). It is generally stated that the larvae of the former pupate in the ground and those of the latter in the ears of the wheat, covering themselves with a transparent wrapping in which they hibernate. According to J. C. H. de Meijere, near Groningen both species pass the winter in the earth, and according to Kieffer the larvae which remain

attached to the ears and are to be found in the chaff, are those of which the development has been arrested or which have been attacked by parasites. De Meijere's statement has so far proved correct, and no parasites were obtained from the larvae. *Contarinia torquens*, de Meijere, distorts the hearts of cabbages, and it was observed at Niedorp in North Holland that a field of cabbages which adjoined a field of oats was heavily attacked in one part and remarkably healthy in that part which was bordered by the oats. The shelter afforded by the higher growing oats cannot be the explanation, because it is precisely in such sheltered conditions that the trouble is greatest, and the connection between the oats and the absence of the pest is by no means clear ; the matter is being further studied. A species of *Tipula* caused very serious damage to grass land in Oberijsel ; the use of a very heavy roller at daybreak has proved more or less effective, the larvae approaching the surface to feed at this time of the day and being thus crushed. *Eumerus lunulatus*, Meig., was found in potato pits in Pesse, but probably had been introduced, possibly with onions, which it frequently attacks. A quantity of hyacinth bulbs yielded larvae greatly resembling those of *Eumerus*, but an attempt to breed out the flies failed. *Oscinella* (*Oscinis*) *frit*, L., was not nearly so destructive as in 1912, when oats, wheat and maize suffered severely. *Chortophila* (*Anthomyia*) *brassicae*, Bouché, has been found to play an important part in the spread of the " falling sickness " of cabbage, the imago distributing the spores of *Phoma oleracea*, Sacc, and the larva providing a means of entry for them ; direct damage by the larvae was also extensive. Good results have been obtained by the use of a solution of potassium permanganate, 1 in 2,000 of water, against *Psila rosae*, L. ; the soil round the plants is first well wetted and then a quantity of the solution is poured close round the root collar. Against *C. brassicae*, collars of tarred paper seem still to be the best remedy. A case of serious attack by aphids on seed-potatoes, which were being sprouted in a cellar, was reported. The owner was advised to expose them to the vapour of carbon bisulphide. Tulip bulbs, which were beginning to sprout, were found to be heavily infested by an aphid, possibly *Aphis tulipae*, Boyer ; the same treatment was successfully used. *Schizoneura* (*Tetraneura*) *ulmi*, de Geer, was found on the upper surface of elm leaves. The stem-mother of *S. ulmi* hatches from a hibernated egg and produces about 40 young, which live in the protecting gall ; this breaks open in June and the stem-mother dies and the young, after several moults, acquire wings and migrate to various grasses, especially oats and wheat ; this winged generation produces wingless young, parthenogenetically, and these descend to the roots ; the progeny (sexuparae) of these are again winged when fully grown and return in August to elms, where they lay large female and small male eggs. The fertilised females lay only one egg, which lies the whole winter under the dried-up body of the parent in a crack in the bark and the cycle begins again. The life-cycle of *Schizoneura* (*Tetraneura*) *pallida*, Halid., is probably similar, but the intermediate host plant is *Mentha arvensis*. Winter spraying with 6 per cent. carbolineum is recommended. *Schizoneura ulmi*, L. (*fodiens*, Buckt.), rolls up and causes the withering of the edges of elm leaves. In the " exsulans " stage it lives on the roots of currant bushes and has thus long been known as *S. grossulariae*, Schule

Emigration from elm to currants takes place in July and August and the return of the sexuparae to the elm in November. It is probable that far more damage is done by this pest than is suspected ; benzine poured into holes in the soil at about 10 inches apart and of the same depth as that at which the aphids are found, is said to be an effective remedy ; about 5 cubic cm. is sufficient in each hole, which should be at once closed. *Pinus cembra* in nurseries near Breda was attacked by *Pineus* (*Chermes*) *sibiricus*, Chol. This pest is generally found where *Picea excelsa* and *P. cembra* are growing together. The life-cycle corresponds with that of *S. ulmi*, only that it lasts two years and the intermediate host plant is a conifer. *Pineus* hibernates as a stem-mother, not as an egg. In spring the stem-mothers, thickly covered with wax, are to be found on the terminal buds at the base of a needle. The shoots are not so much shortened as in the case of attack by *Chermes abietis*, and the needles are broadened and scaly at the base and generally the attacked shoot has a more normal appearance. The winged immigrant progeny of the stem-mother and their winged young, the sexuparae, return to the spruce and there lay eggs from which the sexual forms hatch out. The fertilised female lays one egg and from this the stem-mother hatches. *Hemichionaspis* (*Chionaspis*) *aspidistrae*, Sign., was found on the leaves of *Asplenium nidus-avis* (bird's nest fern) and on *Polypodium laevigatum* ; the males are white and the brownish females attached to the leaf between the rings of spores are not readily visible. *Aspidiotus abietis*, Schr., was found on *Picea pungens*. *Tetranychus telarius*, L., was constantly reported as a pest, and *T. altheae*, Haustein, may also have been present. Sulphur in the finest possible powder, mixed with soapy water ($6\frac{1}{2}$ lb. sulphur and 1 oz. soft soap in 20 gallons of water), was found to be an excellent remedy. *Picea remonti* was attacked by a *Tetranychus* not identical with *T. telarius* and probably *T. ununguis*, Jacobi, though Oudemans regarded the specimens sent to him as *T. carpini*, Oud. A pear branch was received thickly covered with a white mass consisting of moulted skins and empty egg-shells. This was determined by Oudemans as *Bryobia nobilis*, Koch (= *praetiosa*, Koch, = *speciosa*, Koch, = *cristata*, Dug.). It is doubtful whether *Bryobia ribis*, Thomas, is identical with *B. nobilis* or not. *B. ribis* is not to be found after May on gooseberries, but the author has found *B. nobilis* on ivy in mid-winter and it only disappeared under the influence of intense frost and a cold wind. Oudemans determined mites from gooseberries sent to him as *B. nobilis*, but the question of the identity or otherwise of these species and varieties is not finally settled [see this *Review*, Ser. A, ii, p. 169]. *Eriophyes ribis*, Nal., and *E. pyri*, Nal., were frequently reported on black currant and pears ; the former winters in the second and third layer of the bud leaves, and so cannot be reached by carbolineum or other sprays. Against *E. pyri*, a winter spray of 6 per cent. carbolineum reduced the pest in the following year to very small proportions ; a fine sulphur and soap spray applied early in July also proved useful, but winter treatment is best, because it is very difficult to determine the precise time at which to spray with effect in summer. Serious damage to the leaves of *Buxus* (Box) was traced to *E. unguiculatus*, Corn. According to Nalepa, this species causes hairy malformations of the buds, but this was not the case in the specimens sent to the station.

E. violae, Nal., causes curling of the leaves, and it was found that beds manured with superphosphate and potash, and on which ammonium sulphate had also been used, did not suffer. Rapid growth seems to save the plants, otherwise removal of the attacked leaves is the only remedy. *Tylenchus devastatrix*, Kühn, was reported from many districts, damaging rye in some places and, in the flower-growing areas, attacking especially hyacinths. *Galtonia candicans* (summer hyacinth) also suffered from the pest. *Heterodera schachtii*, Kühn, was found on sugar-beet.

De Bussy (L. P.). **Dierkundige afdeeling.** [Zoological Section.]—*Meded. Deli Proefstat., Medan*, viii, no. 7, September 1914, pp. 215–223. [Received 5th December 1914.]

This is a section of the annual report of the Deli Experiment Station for the year ended 1st July 1914. The great drought and the failure of the usual rainstorms which generally kill great quantities of eggs and caterpillars made the year 1914 a serious "caterpillar" year in many places. Just as in 1912–13, *Prodenia litura* was much more prevalent than *Chloridea* (*Heliothis*) *obsoleta*, perhaps because the latter is more readily controlled by insecticides, whereas *Prodenia* can only be kept down by destroying the eggs and caterpillars. Nevertheless, in certain localities, *Chloridea* proved a veritable plague and *Prodenia* was entirely absent; it has been observed before that, in certain cases, one species seems to exclude the other. *Phytometra* (*Plusia*) was always less numerous than either of the above, but in the past tobacco season it was found in some numbers on poor, exhausted land and in the drying sheds. It is noted that the *Prodenia* caterpillars come out of the earth on the floor of the drying sheds and are not carried there with the tobacco, as is the case with *Phytometra*. Young tobacco was severely attacked in some places by "toa-toh," *Phthorimaea* (*Lita*), and, in spite of the rain, whole plantations were destroyed. Tobacco suffered more than any other crop, although covered with mosquito netting as soon as planted out. Even when the plants in the nursery were quite free from this pest, in from one to three weeks full-grown caterpillars were to be found on almost every stalk. A possible wild solanaceous food-plant was found, on which caterpillars very like those of *Phthorimaea* were feeding. These were bred out and a moth also resembling the imago of *Phthorimaea* resulted, but, contrary to experience with that species, the adults did not breed, and it is regarded as a closely allied species or a variety, as it would not oviposit on tobacco. The idea that if tobacco cultivation were abandoned for a time this pest would be starved out is not practical, as there is too much wild tobacco outside the plantations and especially on those which, for rotation, are planted with rice, which has quite wrongly obtained a bad name as a food-plant of this pest. A composite plant known as "sendrong" is feared by the planters because this moth may be found in its heads, but this fear is declared to be baseless. The hawk-moth, *Protoparce convolvuli*, a host of *Trichogramma*, was only reported twice in the neighbourhood of Medan, whereas in 1912–13 it did enormous damage all along the East Coast of the island. *Belippa*, also a serious pest of the previous year, was hardly noticed. The breeding of *Trichogramma pretiosum* in the eggs of

Mocis undata (*Remigia archesia*) is proceeding steadily, but the drought has seriously interfered with their spread. It is often very difficult to find any large numbers of *Chloridea* eggs on tobacco, and the best time to release the parasites is at the moment of appearance of the caterpillars. The report on insecticides shows a notable increase in the use of Paris green. A modification called Urania green is coming gradually into use ; it contains a larger proportion of soluble arsenic, but is liable to cause scorching, and there are complaints of great variation in composition ; zinc arsenite and izal are employed, but not sufficiently to enable an opinion as to their value as insecticides to be given. Mixtures of tapioca flour and Paris green are difficult to prepare and are not recommended, and the use of fine sand as a diluent is objectionable, as when strewn over the plants the falling sand damages the leaves. Aphids are reported to have done but little damage in the year under review, so that there was little opportunity for releasing *Megilla maculata*. Some difficulty has been experienced in rearing this American Coccinellid in captivity, as it requires to be kept more or less in the open and needs light. In September 1914, a quantity of *Megilla* was released on some plantations of "Katjang pandjang" and "katjang poetih" (*Vigna catjang*). Ants and grasshoppers did only very local damage, nothing approaching that of the previous year ; against ants it is important to keep the tobacco seed-beds as far as possible from the rice fields of the previous year. The possibility of locust invasion from the other side of the Straits is being considered ; and as the species concerned has not yet been found in Sumatra, it is thought that conditions at Deli are not favourable to its development. *Opatrum sabulosum* [see this *Review*, Ser. A, i, p. 111] was not reported from a single tobacco plantation ; it was not common in 1913, though in 1912 it was both numerous and destructive. Nevertheless, precautions against it should not be relaxed.

GORIAINOV (A. A.). **Вредители сельско-хозяйственныхъ растенiй Рязанской губернiи.** [The pests of agricultural plants in the government of Riazan.]—Published by the Zemstvo of the government of Riazan, *Riazan*, 1914, 67 pp.

This is a preliminary report on investigations on entomological and phytopathological problems in the government of Riazan. The programme of investigation was (1) to determine by means of molasses-traps the extent of the flight of imagines of *Euxoa* (*Agrotis*) *segetum*, *Feltia exclamationis* and *Trachea* (*Hadena*) *basilinea*, in order to decide whether and which remedies will be necessary in the fields in autumn. (2) To determine the degree of injury to summer and winter-sown crops by *Oscinella* (*Oscinis*) *frit* and *Mayetiola* (*Cecidomyia*) *destructor*, larvae of ELATERIDAE, *Apamea* (*Hydroecia*) *nictitans*, and other insect pests. (3) To determine the extent of injury to clover by various species of *Apion*.

The report also gives a list of orchard pests observed during these investigations. *Hyponomeuta malinellus* and *H. variabilis* take the first place amongst these, and there was no orchard where these insects were not firmly established. The caterpillars were found up to the end of June and the imagines appeared in the first half of July. Over half the pupae were infested with parasites,

from some of which the Ichneumon, *Angitia armillata*, Grav., and a Chalcidid were reared. Spraying with Paris green while the caterpillars are still young and their web small, and the removal of the nests of the caterpillars from the trees by means of a special stick in May and June are recommended. *Aporia crataegi* has also done great damage in some orchards. In some cases, as many as 40 per cent. of the caterpillars and pupae were parasitised by the Braconids, *Apanteles spurius*, Wesm., and *A. glomeratus*, L., and also by some species of Tachinids. This pest mostly injured apple-trees, but also pear, bird-cherry, and sorb trees [*Pyrus sorbus*]. *Malacosoma neustria* was also present, although less widely distributed. *Cydia pomonella* occurred in great numbers, apparently in two generations, an early spring and an autumn one. It is estimated that this pest is responsible for the loss of from 30 to 40 per cent. of the yield of apples, either directly or by providing favourable conditions for the growth of the fungus *Monilia fructigena*. *Psylla mali* figures prominently among the pests and even occupies the first place in some districts. Remedies against the eggs consist of spraying with a mixture of from 1 to 2 lb. iron sulphate, about $\frac{1}{4}$ lb. of rye meal, or even better, 2 to 3 spoonfuls of joiner's glue, in $2\frac{3}{4}$ gallons of water, in spring, before the swelling of the buds, and repeating it in a day or two; against the nymphs, spraying with quassia, kerosene emulsion, tobacco extract or decoction, when they have not yet penetrated into the buds; and against the imago, fumigation with tobacco smoke, before ovisposition. *Lepidosaphes ulmi* is mostly found on old trees, but is not considered a serious pest. *Chionaspis furfura*, which attacks currants, is more dangerous; red currants in one orchard were not affected by this scale. The smearing of the bushes in winter with kerosene emulsion, and in spring with a mixture consisting of 20 lb. of crude carbolic acid and 20 lb. of soap in 27 gallons of water, is recommended. *Anthonomus pomorum* does damage in some districts amounting to 50 per cent; notwithstanding the intense heat of the summer, weevils were found underneath the bark of trees as early as 17th July, having evidently retired for the winter, which shows that trap-belts must be put on not later than the first half of July. The sawfly, *Hoplocampa testudinea*, was found in the larval stage on 18th June in one orchard, the damage done being estimated at 10 per cent. *Eriocampoides limacina* (*Eriocampa adumbrata*) was observed in small numbers in the larval stage on cherry leaves in the first half of August. A Chalcid parasite, not identified, has been observed to damage young apple trees, mostly near the roots. The following insects have a secondary importance in orchards: *Episema* (*Diloba*) *coeruleocephala*, L.; *Acronycta tridens*, Schiff.; *A. psi*, L.; *Hemerophila* (*Simaethis*) *pariana*, Cl.; *Luperus flavipes*, L.; *Rhynchites pauxillus*, Germ.; *Pteronus* (*Nematus*) *ventricosus*, Kl., on red and white currants, but not on black; and *Byturus tomentosus*, F.

Pests of market gardens included: *Phyllotreta nemorum*, L.; *P. atra*, L.; *Haltica oleracea*, L.; *Pieris brassicae*, L.; *P. rapae*, L.; *P. napi*, L.; *Barathra* (*Mamestra*) *brassicae*, L., against which hand-picking the caterpillars was tried, but spraying with Paris green found to be preferable; *Plutella maculipennis* (*cruciferarum*) of which it is thought that three generations occur; and the cabbage fly, *Chortophila brassicae*, Bouché, the larvae of which injured some 40 per cent. of

the stalks of hemp in the district of Michailovsk, and which was said to have done much greater damage in the previous year.

The following pests of field crops are reported:—Lepidoptera: *Euxoa segetum*, and *Feltia exclamationis*, the existence of a second generation of which has not yet been definitely established. The remedies given against these moths are careful removal of weeds, occupied fallow [see this *Review*, Ser. A, ii, p. 316], molasses traps, spraying with Paris green round the bare spaces, trap crops of beet, cabbage or potatoes and protective trenches round fields or parts of them. The caterpillars of *Apamea* (*Hydroecia*) *nictitans*, Bkh., were observed on summer-sown oats, the damage in some cases amounting to 35 per cent. The burning or deep ploughing of stubble late in autumn, followed by the reploughing of the fields intended for sowing summer crops early in spring, and trenches round the fields, are recommended as remedies. *Pyrausta nubilalis* has injured millet fields. The imagines of *Chloridea* (*Heliothis*) *dipsacea* were observed on some lucerne fields, but no damage by the caterpillars was noticed. *Phlyctaenodes sticticalis*, L., has also not done any damage, although present. *Ochsenheimeria taurella*, Schiff., has been reported as injurious from all parts of the government. *Trachea* (*Hadena*) *basilinea*, was found in more or less large quantities during the harvest; should it be noticed in grain stores, the grain must be screened; the sheaves must be stored loose, so as to allow the circulation of cold air through them, and the thrashing in spring must be done as early as possible; the caterpillars left in the fields after the harvest must be destroyed by burning the stubble or by burning them with heaps of straw spread on the fields over night, under which they collect. Coleoptera: Larvae of ELATERIDAE and TENEBRIONIDAE have injured oats and rye in some districts, the stems withering and being easily detachable from the root, without showing a clean cut, as is the case when the injuries are caused by the wheat sawfly, *Cephus pygmaeus*. The remedies suggested are, hand-picking the larvae, for which purpose various baits are required; poisoned baits of clover; trenches 7 to 9 inches deep round the fields, the wall facing the protected part to be made vertical; and mineral manures. *Anisoplia crucifera* appears later and is more important than *A. segetum*, as it feeds on young, undeveloped grain. A species of *Apion* was everywhere found more frequently on *Trifolium pratense* than on *T. repens*. Several samples showed a maximum infestation of 58 per cent. The mowing of clover in the first half of June is advised, leaving trap-strips of unmowed clover, which are cut down when the larvae appear and given to cattle as food. Clover fields may be sprayed in May and also at the end of June with Paris green (10 grammes of green, 33 grammes of freshly slacked lime in 1 litre of water, some molasses being added). Weevils of the genus *Sitones* injured vetches, and *Haltica oleracea*, lucerne. *Bruchus pisorum*, L., has damaged peas in one district; peas should be put in water before sowing, which will cause the damaged ones to rise to the surface, where they can be collected and destroyed. *Apion craccae*, L., injured the pods of vetches. Rhynchota: *Aelia acuminata*, L., and *Eurygaster maurus*, L., are found everywhere. The Capsid, *Trigonotylus ruficornis*, Geof., occurred everywhere in July, but in small

numbers. *Macrosiphum granaria*, Kirby, is a common aphid, attacking winter-sown rye, wheat and oats. Various aphids were noticed on vetches, but they were all but totally destroyed by the larvae of ladybirds, principally *Coccinella punctata* and *C. bipunctata*, by Syrphid larvae and by parasites. Thysanoptera : *Haplothrips tritici*, Kurd., and *Stenothrips graminum*, Uzel, were found in great numbers, the former being the more numerous and attacking rye and clover, and the latter, oats. Diptera: *Oscinella frit*, L., is distributed over the whole of the government, the infestation of oats being estimated at 30 per cent. *Mayetiola destructor*, L., was found only occasionally. *Lasioptera cerealis*, L., occurred in some places on barley and rye, accompanying other, more serious pests. A mite, *Pediculopsis graminum*, injured oats and wheat in the district of Riazhsk in June ; it is probable that this pest is responsible for the turning white of half of the damaged ears, the remainder being caused by *Ochsenheimeria taurella*, Elatrid larvae and various Diptera.

In a supplement, recipes and methods of preparation and application of various insecticides and the rules for spraying fruit trees and bush fruit are given. A second supplement contains a list of 58 species of moths captured in molasses troughs between the 2nd June and 9th September.

GOMILEVSKY (V.). **Грецкій или Волошскій Орѣхъ.** [The Walnut (*Juglans regia*, L.).]—Published by the Rostov-on-Don Society of Horticulture. Supplement to **« Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, 1915, 26 pp., 2 figs.

The leaves of walnuts are attacked by aphids, by the mite, *Phyllereus juglandis*, by caterpillars of *Gracilaria juglandella, Dasychira pudibunda, D. fascelina*, and *Amphipyra pyramidea*, and occasionally in the absence of other food, by *Melolontha melolontha*. Paris green is recommended against the various caterpillars and kerosene emulsion, quassia, etc., against the aphids and mites. The shoots and young branches of walnuts are damaged by *Eulecanium* (*Lecanium*) *juglandis*, which can be destroyed by brushing with soapy water, preferably after the leaves have fallen ; also by a weevil, *Peritelus griseus*, Ol., against which shaking down from the trees is recommended. A special appliance for this purpose, recommended by Portchinsky, is described, consisting of a piece of cloth mounted on two sticks and lined with cotton wool or waste, so as that the insects should not be able to free themselves as they fall ; a third stick is fastened across the cloth with rings and serves for carrying it. The apparatus is held with the left hand while the right one shakes the branches ; the beetles are destroyed by burning them together with the wool or waste.

Adults and larvae of the Scolytid, *Taphrorhynchus* (*Bostrychus*) *bicolor*, Herbst, and the caterpillars of *Zeuzera pyrina* (*aesculi*) are found in the wood and beneath the bark. Cutting and burning the damaged branches or smearing them with a solution of lime to which iron sulphate is added (40 lb. of lime to 1 lb. of iron sulphate), are suggested. The trunks of old walnut trees are also attacked by various insects, such as *Cossus cossus* (*ligniperda*) and the Longicorn beetles, *Saperda scalaris, Haplocnemia* (*Mesosa*) *curculionoides*, and *Liopus nebulosus*. Washing and cleaning the wounds in the trunk and closing them with

putty, and the smearing of the trunks with lime and iron sulphate as directed above, so as to prevent the beetles from ovipositing upon them, are recommended.

The fruits of walnuts are attacked by a mite of the genus *Eriophyes* and by caterpillars of *Cydia* (*Grapholitha*) *amplana*, Hb. Stored nuts are frequently damaged by the beetles and larvae of *Silvanus surinamensis* (*frumentarius*). *C. amplana* feeds exclusively on the parenchyma of the nut, gnawing the pericarp near the pedicle; the females attach their eggs to the fruits, leaves, etc., and the caterpillars hatch out in about a week. Two generations occur yearly, the second generation of caterpillars wintering in the cocoons and pupating next spring. The cleansing of the trunk and of the thick branches, thus destroying the cocoons of the pest, followed by smearing with a lime solution, the use of trap belts and the destruction of fallen fruits, are the remedies recommended.

FORTI (C.) & BROGGI (E.). **Brevi notizie pratiche sui principali nemici delle piante coltivate.** [Brief practical notes on the chief enemies of cultivated plants.] Como: Cesare Nani & C., 1914, 155 pp., price 80 ctmi.

This little book is a reprint of a series of articles which appeared in *La Campagna*, the official journal of the *Cattedra Ambulante di Agricoltura* of Como, and consists of a brief summary of the principal fungus and insect pests of cultivated plants. Under each plant is given a list of pests, with a brief description of the damage done and the appropriate remedies. The descriptions given of larvae are in many cases too vague to be of real use, the insect nomenclature needs revision and in many cases only an Italian popular name is given.

GUPPY (P. L.). **Report of the Entomologist in Charge of Froghopper Investigation for the Months of October and November 1914.**—*Report to the Colonial Office, dated 11th December 1914.*

Experiments to determine the rate of egg-laying by female Syrphids [*Salpingogaster nigra*] show that the number laid under laboratory conditions is considerably below that under natural conditions, but about 150 can be reckoned upon for each fertilised female in captivity; Kershaw, by dissection, found upwards of 350 eggs in the ovaries. During October, the author was able to send out 500 eggs, besides retaining a considerable number for experimental purposes. It is considered that the breeding process requires too constant and minute attention to be generally undertaken by planters themselves. This fly saves planters thousands of dollars annually, being an invaluable insect ally, and its efficiency can be greatly increased by introducing it early in the wet season. It destroys the majority of the third brood of froghopper nymphs [*Tomaspis saccharina*], allowing the canes to recover from attacks of previous broods, which, with the help of favourable weather, they nearly always do. The green muscardine fungus [*Metarhizium anisopliae*] is also a great help at this time of the year, but only affects the adults, and the adult froghopper has never been found to be attacked by the fungus outside the cane fields.

The reason that froghopper infestation follows cleaning and weeding, is that the froghoppers are driven from the wild plants on to the canes. Whenever adults are seen to be numerous around a field it is better to wait until they die off before cleaning up ; this would give them time to oviposit, and the weeding and trashing would be effective in destroying eggs and nymphs. If, however, cane-trash is merely heaped up and left in the field, the incubation of the eggs is assured, if not actually hastened. It is important to note the appearance of adults on the paths and around the fields when brushing and weeding operations are contemplated ; in certain conditions, the froghoppers prefer paths and drains, which are two of the principal sources from which fields become infested, and the weeding, not brushing, of these is recommended at the proper time [see this *Review*, Ser. A, ii, p. 96].

The method of transporting adults adopted, is given, as well as a few notes on Syrphid breeding ; the distribution of an additional 500 eggs is recorded.

Hewitt (C. G.). **Instructions to Importers of Trees, Plants and other Nursery Stock into Canada.**—*Domin. Canada, Dept. Agric., Entom. Branch, Ottawa*, Circular no. 4, August 1914, 11 pp. [Received 2nd November 1914.]

The authorship of this paper, of which an abstract has already appeared [see this *Review*, Ser. A, iii, p. 32 (January 1915)], was erroneously attributed to the Minister of Agriculture instead of to Dr. C. Gordon Hewitt. The reference, etc., should read as above.

Illingworth (J. F.). **Further Notes on the Breeding of the Tachinid Fly Parasitic on the Cane Beetle Borer.**—*Jl. Econ. Entom., Concord*, vii, no. 5, October 1914, pp. 390–398, 1 pl.

The authorship of this paper, of which an abstract was given on p. 88, vol. iii (February 1915) was, through a printers' error, attributed to " Mingworth," instead of to Dr. J. F. Illingworth.

Hukkinen (Y.). **Vanliga Stinkflyet.** [The common stinkfly (*Dolycoris baccarum*).]—*Agrikultur Ekonomiska Försöksstationen i Finland, Avdelning för Entomologi. Meddelande till Landmän no. 34, Helsingfors*, 1914, 9 pp., 6 figs.

This is a short treatise on the plant bug, *Dolycoris baccarum*, giving information on its systematic characteristics, biology and development, the damage caused by it in the beginning of the summer and the control measures against it. The insects are full grown at the end of July and the beginning of August. The species has been recorded from young fruits and berries and on young shoots of several orchard plants. During the recent dry and warm summers it has increased considerably in numbers and, as a consequence, has begun to attack other plants, such as cereals, turnips, cabbage, etc. This happened for the first time in Kuhmois in 1912. The most serious attacks have been on turnips, clover, barley and rye, but even cabbage and potatoes have been injured. On swedes, cabbage and potatoes, the leaves and shoots are injured and wither

completely, but on young turnips the upper parts of the roots are attacked, with the result that the growth of the plants is stopped and they become dwarfed and mis-shapen. On clover, chiefly red clover, they gather in the flowers at the time when the seeds are formed and destroy them. On rye, they occurred in such numbers that at the threshing, the workers were made sick by the stench from the crushed bugs.

As regards control measures, careful observations must be made in order to detect the occurrence of this pest in good time. The egg clusters, containing about 50 eggs, can then easily be destroyed. It is essential to eradicate all weeds, as these furnish the bugs with good breeding places. The nymphs can be collected with nets or destroyed with sprays such as 2 to 4 per cent. lysol emulsion, or tobacco or quassia sprays. The imagines may also be collected with nets. The attacks on young turnips can be prevented by covering the roots with earth.

DOBRODEEV (A. I.). **Виноградныя листовертки, двулѣтная и гроздевая, и мѣры борьбы съ ними по новѣйшимъ изслѣдованiямъ.** [*Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff., and methods of controlling them according to the latest researches.] — **«Труды Бюро по Энтомологiи Ученаго Комитета Глав. Управ. З. и З.»** [*Memoirs of the Bureau of Entomology of the Scientific Committee of the Central Board of Land Administration and Agriculture*], *Petrograd*, xi, no. 5, 1915, 37 pp.

Of the five species of TORTRICIDAE which are found on the vine, *Clysia ambiguella* and *Polychrosis botrana* are mainly dealt with, the remaining three species, *Sparganothis* (*Oenophthira*) *pilleriana*, *Cacoecia costana* and *Tortrix loeflingiana*, being less important. *Polychrosis viteana*, Clemens, which does enormous injury to vines in America, is considered to be identical with *P. botrana*. *Clysia ambiguella* has two generations yearly. The imago appears in spring, issuing from the wintering pupae in the first half or the middle of May. The imago requires moisture especially during the period of oviposition, and accordingly appears in larger numbers and multiplies more freely in damp places, and during wet summers. The life of the imago of the first generation lasts about three weeks, that of the second not more than one week. The females oviposit singly on the blossoms, not on unfolded buds, on the bracts or pedicels of vine, mostly at dusk or during wet days, each female depositing from 50 to 70 eggs or more. The total number of eggs in their ovaries is 120–160, but they never deposit the whole of these. In dry weather a great proportion of the eggs dry up and perish. The caterpillars, which emerge from the eggs during the night or on wet days, spin a web round the buds and feed inside it ; for protection against bad weather they spin a thicker "tube" inside which they pass the day, issuing at dusk to feed. The pupal stage lasts two weeks, the emerging females ovipositing on the grapes. These females of the second generation deposit fewer eggs, approximately 15–30, which develop in about four days, and the caterpillars eat into the grapes when half out of the eggs ; they do not spin any web, living inside the grapes, and leaving them only when the latter become too soft. The differences in the habits of the

two generations depend on the difference in the meteorological conditions. Dry weather and a high temperature affect all the stages of the pest; the moths perish in such weather without being able to oviposit or after depositing only a small number of eggs; the eggs dry up, the caterpillars are smaller in size, and they are either unable to pupate, or the pupae dry up and perish. This is the reason why the second generation is usually less numerous than the first and why it frequently does not appear at all. Besides the vine, these pests live on many other plants, which frequently accompany the cultivation of the vine and which may either serve to draw away the pests from the vine or afford favourable conditions for the development of the pests before their migration to the vine. A list of 15 species of food-plants, belonging to eight families is given, viz.:—*Rhamnus frangula* [buck thorn]; *Euonymus europeus*; *Ribes nigrum* [black currant]; *R. rubrum* [red currant]; *R. grossularia* [gooseberry]; *Cornus mas*; *Cornus sanguinea* [dog wood]; *Prunus spinosa* [black thorn]; *Acer campestre* [field maple]; *Ligustrum vulgare* [privet]; *Syringa persicum*; *Viburnum lantana* [wayfaring tree]; *Viburnum opulus* [guelder rose]; *Sambucus racemosa* [scarlet-berried elder]; *Hedera helix* [ivy].

Polychrosis botrana, Schiff., the bionomics of which are generally similar to those of *Clysia*, is described. The life of the imago is shorter, being about two weeks. *P. botrana* suffers also from heat and dry weather, although to a less degree than *C. ambiguella*, as was observed by Feytaud in France in 1911, when the latter species perished, while *P. botrana* continued its development. It is also photophobic during the day, but is not attracted by light at night. The caterpillars do not spin a web and do not eat out the lignum of the shoots. The pupae of the second generation remain over the winter. This pest also feeds on other plants and it is thought that it prefers *Daphne gnidium* to vine. The following list of 19 food-plants is given: *Zizyphus vulgaris* [jujube]; *Clematis vitalba* [traveller's joy]; *Medicago sativa* [lucerne]; *Trifolium pratense* [purple clover]; *Ribes rubrum*; *Ribes nigrum*; *Rubus fructicosus* [blackberry]; *Ampelopsis quiquefolia* [Virginia creeper]; *Cornus sanguinea*; *Prunus spinosa*; *Viburnum lantana*; *Ligustrum vulgare*; *Rhus glabra* [sumach]; *Rosmarinus officinalis* [rosemary]; *Galium mollugo* [bed-straw]; *Silene inflata* [bladder campion]; *Arbutus unedo* [strawberry tree]; and possibly on certain species of tulip and magnolia. The shading of vine-clusters increases the extent of oviposition, while their exposure to the sun's rays has an opposite effect. Plenty of moisture and the situation of vineyards in wet and low-lying places, tend to increase the rate of infestation, and the cultivation of vines in places protected from wind or in the form of vine arbours or arches, as is usual in Astrachan, also provides conditions favourable to the insects. The close planting of vines has the same effect. The tying of the branches round poles and the espalier method of cultivation afford better protection. "Pinching" must be done before the oviposition has been effected and the watering after the hatching of the caterpillars. Attention must also be paid to the selection of the proper type of vine; according to Marchal those with short and thick inflorescence, such as "Pignon" and "Folle Blanche," were more affected than those with long and straggling inflorescence, such as

"Negrot" and "Colombard." According to Feytaud, who confirms the above statements, the types with a lengthy period of blossoming also suffer more; when selecting vines preference ought to be given to those proof against dry weather, and having a suitable period of blossoming and form of inflorescence; according to French authors, the varieties "Saint-Emilion" and "Uniblanc" are those most proof against the pests.

A list of birds and the following predaceous insects which reduce the numbers of the two pests, are given: Neuroptera: *Chrysopa perla*, L., *C. vulgaris*, Schn., *C. septempunctata*, Wesm., *Myrmeleon* sp., *Palpares libelluloides*, L.; Orthoptera: *Forficula auricularia*, L., *Labidura riparia*, L.; Coleoptera: *Calosoma sycophanta*, L., *Denops albofasciatus*, Charp., *Opilo mollis*, L., *Malachius bipustulatus*, L., *Coccinella semptempunctata*, L.; Hymenoptera: *Zicrona coerulea*, *Odynerus chevrieranus*: Hemiptera: *Nabis rugulosus*; and SYRPHIDAE.

The parasites, which are more important, include:—CHALCIDOIDEA: *Trichogramma semblidis*, Auriv., *Eulophus polydrosis*, Marchal, *Pteromalus vitis* and *Caenacis parviclava*, Thoms.; ICHNEUMONIDAE: *Pimpla alternans*, Grav., *P. strigipleuris*, Thoms. *P. turionellae*, L., *Omorgus difformis*, Gmel., *Angitia* (*Dioctes*) *melania*, Th., *A. exareolata*, Ratz., *Cryptus minutulus*, *Phygadeuon eudeminis*, *P. varicornis*, Thoms., *Angitia vestigialis*, Ratz., *A. fenestralis*, Holmgr., *A. areolaris*, Holmgr., and *Microcryptus nigrocinctus*, Thoms. *Hemiteles areator*, Grav., and *Pezomachus botrana*, according to Catoni, are hyperparasites, parasitising *Pimpla*. From the pupa of *Polychrosis botrana*, a Tachinid, *Phytomyptera nitidiventris*, Rond., has been reared. The following fungi attack both species: *Citromyces glaber*, Wehm., *Verticillium heterocladum*, Pentz., *Botrytis bassiana*, Bals., and *Isaria farinosa* var. *verticilloides*, Fron., while *Coccobacillus acridiorum* is reported as infesting only *P. botrana*.

The remedies against these pests are divided into mechanical and chemical and are described in detail, with references to the observations and experiments of French, German and Italian authors. The mechanical remedies consist of:—The use of powders, such as lime and gypsum, in order to prevent the moths from ovipositing on the grapes; the destruction of the wintering pupae by crushing them with gloves or metallic brushes, by pouring water at a temperature of 112–133° F. over the vines and stakes, by applying trap belts as recommended by Catoni, and by covering the young branches, stakes, etc. during the winter with earth about one inch thick; this latter remedy is used in Germany, where it is done between the second half of November and the end of December and leads to the destruction of the pupae, the parasites, according to Vetter, remaining alive; the catching of the imagines of *C. ambiguella* at light or traps such as sticky belts or baits attracting the moths by their smell, etc.; the collection and destruction of the caterpillars together with the injured fruits, and the bag treatment, as practised in America.

The chemical remedies consist of spraying with insectifuges, the best of which are those which contain nicotine, while chloroform, nitrobenzol, sulphuretted hydrogen, pitch, essence of orange blossoms, mint, eucalyptus, rosemary, cinnamon, and geranium, the preparation "Rubina," consisting of pitch and caustic soda, and preparations containing pyridine are also used; spraying with various insecticides,

especially those containing nicotine, which destroys the eggs and acts also through the skin of the caterpillars, and those containing arsenical salts of lead and copper and a lime-sulphur mixture, which act as internal poisons.

SACHAROV (N.). **Блошки, вредящія посѣвамъ горчицы и мѣры борьбы съ ними.** [Flea-beetles (*Phyllotreta*) injurious to mustard crops and methods of controlling them.] Published by the Entomological Station of Astrachan, *Astrachan*, 1915, 7 pp. 1 fig.

This book is a continuation of the author's work on pests of mustard [see this *Review*, Ser. A, ii, p. 355]. The following species of flea-beetles discovered on mustard in the government of Astrachan are described :—*Phyllotreta cruciferae*, Goeze, *P. atra*, F., *P. undulata*, Kutsch., *P. nemorum*, L., and a species which is perhaps new. The last-named, occurs only in the northern parts of the government, while the others are found all over it, the most injurious being *P. cruciferae*, *P. atra* and the new species, while *P. nemorum* and *P. undulata* appear only in small numbers. They winter in the adult stage and appear early in spring, first on wild Cruciferae and then on cultivated plants ; in Astrachan, the first beetles on winter-sown mustard were noticed on 1st April, and in Zarevsk, on 5th May. They remain in varying numbers on the fields till the ripening of the mustard. The beetles feed mostly on the upper sides of the leaves and do the greatest damage to the young plants. Control measures must therefore be undertaken early in spring on the seedlings. Remedies such as powdering with ashes, lime, tobacco dust or basic slag, only drive the beetles off the fields ; while spraying with Paris green gave negative results, it being difficult to spray effectively the small leaves of the seedlings. The best and least expensive remedy consists in catching the beetles on sticky material by means of the special "Göttingen" trolley, which however requires much time for cleansing and resmearing of the cloth, or by means of a special appliance described and figured, consisting of a square batten 7 feet long or of a rod not thicker than 2 inches to which a piece of cloth about 5 feet long and 2 feet wide is fixed with nails ; some tanglefoot (or a mixture of 1 part of cart grease and 2 parts of naphtha) is smeared over the cloth, a strip of about 2 inches at the bottom of it being left clean in order not to soil the plants. Two boys drag the apparatus over the seedlings and the contact of the cloth with the plants causes the beetles to jump up and be captured. The cloth must be cleaned and resmeared when necessary and the process of catching repeated. This method can be applied only in dry weather during the heat of the day. Sowing wheat mixed with mustard is also recommended, so that if the pest destroys the mustard, the whole crop will not be lost. It has also been observed that in such mixed crops the mustard suffers less from this and other pests.

A mite injurious to stored mustard, *Tyroglyphus* (*Aleurobius*) *farinae*, Koch, is described. Another mite, *Cheyletus eruditus*, appears with it, which according to Portchinsky is predaceous upon it. Fumigation of stored mustard seed with carbon bisulphide is recommended.

KOZHEVNIKOV (Gr.). **Научные интересы въ Прикладной Энтомологiи.** [Scientific interests in Applied Entomology.]—**« Вѣстникъ Русской Прикладной Энтомологiи.»** [*Messenger of Russian Applied Entomology*], *Kiev*, 1915, no. 4, pp. 101–109.

The possibilities of scientific research in Applied Entomology are discussed and the establishment of scientifically equipped Entomological Stations, where zoologists and entomologists could work hand in hand, advocated. The questions which could be investigated as a result of such co-operation, are important both from a scientific and practical point of view and would assist the control of insect pests. Illustrations of such questions in entomological research are given, such as :—The variations in the number of eggs laid in a given locality and the causes of this phenomenon ; the influence of meteorological and climatological conditions on the time necessary for the development of the egg and other stages ; the effect of different influences on growth, fertility, etc. Such general questions of biology, as the struggle for existence, natural selection, sexual selection, protective characters, various anatomical questions and many others, can be successfully and conveniently studied in insects. While the necessity for specialisation is admitted, the importance of breadth of view in investigation is emphasised.

The three following articles have been translated from **« Вѣстникъ Русской Прикладной Энтомологiи »** [*Messenger of Russian Applied Entomology*], *Kiev*, 1915, no. 4, by permission of the Editors.

MAKAROV (V.). **Цементныя ловчiя кольца и ихъ примѣненiе въ плодоводствѣ.** [Cement traps and their use in orchards.]—**« Вѣстникъ Садоводства, Плодоводства и Огородничества.»** [*Messenger of Horticulture Fruit-growing and Market-gardening*], *Petrograd*, 1914, no. 3, pp. 271–274.

About a year ago, Mr. Prichodko (Station Merefa, Southern Railway) invented and put on the market cement troughs for the protection of fruit trees from pests. These troughs are supposed to prevent insect pests, chiefly various CURCULIONIDAE, from getting on to the trees from the soil. Each consists of two semicircular gutter-shaped halves which are fixed in the earth round the trunk by means of cement ; water mixed with naphtha or kerosene is poured into the circular gutter thus obtained. Three sizes are manufactured, from 6½ to 14 inches in diameter, weighing from 9 to 32 lb. and costing from 4½d. to 7½d. each. They were tested in 1911, at the Agricultural School at Uman and some disadvantages were noticed. Owing to their size, they prevent close approach to the trees for the purpose of various operations and they must be removed in winter, otherwise they burst. The author of the article does not say how far they accomplish their purpose.

Отчетъ о дѣятельности Рижскаго Отдѣла Императоркаго Общества Садоводства за 1913 годъ. [Report on the work of the Riga branch of the Imperial Russian Society of Horticulture for 1913.] **« Вѣстникъ Садоводства, Плодоводства и Огородничества.»** [*Messenger of Horticulture, Fruit-growing and Market-gardening*], *Petrograd*, 1914, no. 8–9, pp. 716–742.

In the orchard on the farm of Bilderlingshof belonging to the Society, the following insect pests were noticed in 1913 :—*Anthonomus pomorum*, L., *Hemerophila* (*Choreutis*) *pariana*, Cl., *Cydia* (*Carpocapsa*) *pomonella*, L., *Recurvaria* (*Gelechia*) *nanella*, Hb., *Psylla pyricola*, Forst., *Aphis pruni* and *Lepidosaphes ulmi*, (*Mytilaspis pomorum*, Bouché). The caterpillars of *H. pariana* of the second generation were specially injurious, as many as seven specimens being found on one leaf. Trap belts of wood-wool, mats, straw and felt were put on the trees against *C. pomonella*, the felt apparently capturing the largest number of caterpillars. *A. pomorum* was observed in small numbers. Against *Psylla pyricola*, which appeared at the approach of autumn in great quantities, repeated spraying with 6 per cent. of iron sulphate during the dropping of the leaves was applied and the pests were totally destroyed ; one spraying proved insufficient. The destruction of aphids on plum trees was effected by one spraying with a solution of quassia. The trunks affected by *Lepidosaphes* were washed in spring with a 10 per cent. solution of iron sulphate, which, however, did not kill all the insects.

Polovnikov (P.). **Нѣсколько словъ о мѣрахъ борьбы съ хрушемъ.** [Some words on the methods of controlling cockchafers.]—**« Лѣсной Журналъ.»** [*Forestry Journal*], *Petrograd*, xliv, no. 2, 1914, pp. 213–216.

The usual remedies against *Melolontha* are hand collection, clean cultivation, ploughing at the end of the summer in the year when the adults are numerous, breaking up the soil between the rows of trees, and clearing rides 350 feet wide. These remedies are examined and their disadvantages considered. It is pointed out that hand collection is very difficult in older plantations and only effective if applied everywhere ; cultivation, ploughing, and breaking up the soil require the preliminary removal of the stumps which is not always possible in extensive forests. The evil will be aggravated if the breaking up of the soil is discontinued, as is shown by observations on 10 or 11-year-old plantations in the Selishtchensk and Kozhnov forests, which are heavily infested with the larvae of *Melolontha*. The effectiveness of rides or cuttings, 350 feet wide, is denied.

Balabanov (M.). **Полезно-ли въ садахъ известковое опрыскиваніе?** [Is lime-spraying in orchards useful ?]—**« Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 1, January 1915, pp. 14–16.

The beneficial results of spraying with lime early in spring, before the leaves appear, against various fungous diseases and insect pests are described. Against larvae of *Psylla mali*, adding green soap to the lime solution in the proportion of 1 lb. of soap to 24 gallons of the solution is advised, and the spraying should be made as soon as the

first larvae can be observed, under a lens, to have hatched from the eggs ; the spraying will kill both the emerged larvae and those still in the eggs, the shells of which become very thin at the time when hatching starts. Lime spraying is also very useful against *Anthonomus pomorum*, especially if coupled with trap-belts, so as to catch the females which, unable to fly, will try to get back over the trunk to the buds to oviposit there ; the belts must be inspected every morning and the captured females destroyed.

LAVRENKO (A. N.). **Щитковая яблонная тля или яблонный червецъ и мѣры борьбы.** [*Lepidosaphes ulmi* and remedies.]—**« Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 1, January 1915, pp. 65–68.

Lepidosaphes ulmi (*Mytilaspis pomorum*) is frequently found in large numbers in orchards of Central and Southern Russia on the bark of various trees, causing serious damage and chiefly attacking weak and badly nourished trees. The females oviposit in August, the eggs winter, and the larvae emerge in the succeeding May. The following remedies are recommended : Smearing the infested trunks and thick branches with carbolineum, to which milk of lime can be added (1 part of carbolineum to 3 or 4 parts of lime), or with California mixture prepared as follows : 10 lb. of quick lime is slaked in the required amount of water, adding at the same time 10 lb. of sulphur ; this mixture is dissolved in water and boiled till it turns an amber yellow colour, adding gradually a solution of 2 lb. of salt and boiling for another $1\frac{1}{2}$ hours. Spraying the trees in winter with a 10 per cent. solution of carbolineum and in spring with 5 per cent. kerosene emulsion is also useful. The spring spraying must be repeated three times, at intervals of two or three days, and is directed against the emerging larvae ; the time of emergence must be ascertained by means of observation, through a lens, of infested branches, kept specially for this purpose. Scalecide may be successfully used as a spray.

BALABANOV (M.). **Дешевыя липкія кольца.** [Cheap sticky-belts.]—**« Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture and Market-gardening*], *Petrograd*, no. 51, 3rd January 1915, pp. 1576–1577.

The author repeats the receipe for preparing an adhesive for trap belts which was given in No. 14, 1907, of the same journal by D. P. Alferov, viz. :—$2\frac{1}{2}$ lb. of hard black pitch or other kinds of pitch are dissolved in a kettle on the fire, after which $2\frac{1}{2}$ lb. of " Mazut " (gas tar or naphtha residue) is added and stirred in ; the kettle is then removed from the fire and about 5 lb. of ordinary cart grease added ; the mixture is then quite ready for use. Should the preparation be too liquid some more pitch must be added ; should it, on the contrary, be too thick, add some more Mazut. The above quantity will suffice for 50 large-sized apple and pear trees at a cost of about $\frac{1}{4}$d. per tree. The author has used this mixture with great advantage, preparing the belts from ordinary packing paper. He reminds fruit-growers that in the southern governments such belts must be put on the trees in the first half of March, and in the central governments in the second half of that month, or even earlier, in case of an early spring.

NOTICES OF ENTOMOLOGICAL APPOINTMENTS, &c.

Mr. E. R. Speyer has taken up a temporary appointment under the Ceylon Government for the purpose of investigating the shot-hole borer of tea (*Xyleborus fornicatus*).

With great regret we have to announce the death of the two following Entomologists :—

Mr. Andrew Rutherford, Government Entomologist in Ceylon, who died of enteric fever in February last.

Second Lieutenant Duncan H. Gotch, Worcestershire Regiment, Entomological Assistant in the Imperial Bureau of Entomology, who was killed in action at Neuve Chapelle on the 11th March.

NOTICES.

The Editor will be glad to receive prompt information as to the appearance of new pests, or of known pests in districts which have hitherto been free from them, and will welcome any suggestion the adoption of which would increase the usefulness of the Review.

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Bureau, are requested to communicate with the Assistant Editor, 27, Elvaston Place, Queen's Gate, London, S.W.

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THE REVIEW OF APPLIED ENTOMOLOGY.

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RODZIANKO (V. N.). **О нѣкоторыхъ насѣкомыхъ, вредящихъ лѣсоводству въ Прибалтійскихъ губерніяхъ. Отчетъ о дѣятельности въ 1914 году.** [On some insects injurious to forestry in the Baltic governments.] *Report of the Laboratory of Forest Entomology for 1914, Riga,* 1915, 15 pp.

This Laboratory was instituted in February 1914, under the directorship of the author, as a branch of the Baltic Station for the control of pests of cultivated plants. The following insects are dealt with:—The Scolytid, *Ips* (*Tomicus*) *typographus*, L., is the most important pest of forests in the Baltic governments, hatching out yearly in considerable quantities, not only on fallen or felled wood, but also on standing trees. In 1914, this insect destroyed many hundreds of fir trees, as was also the case in 1913, when thousands of firs had to be barked. *Pityogenes* (*Tomicus*) *bistridentatus*, Eichh., was noticed in one pine forest. The author expresses the opinion that this species and *P. quadridens*, Hart., are not distinct. The adults of *Dryocoetes autographus*, Ratz., were found beneath the bark of felled firs in June. *Hylastes ater*, Payk., was on the wing in May in a forest near Riga. The adults only are injurious, attacking young pines, of which they gnaw the bark. They were also found underneath the bark of old pines. The removal of the attacked stumps and the use of trap trunks may be recommended as remedies. *Myelophilus* (*Hylesinus*) *piniperda*, L., *M. minor*, Hart., and *Pityogenes* (*Tomicus*) *chalcographus*, L., were also found in 1914, the first two on pines and the third on firs. The general remedies against SCOLYTIDAE applied in the forests of the Baltic governments are: The felling of infested trees, followed by the removal of the bark from them, as well as from fallen trees and trap trunks. The removed bark is either burned or left in heaps. The author suggests the desirability of beginning experiments in Russia for the control of these pests by smearing the trunks with various insecticides, similar to those used in North America. *Anthaxia* (*Buprestis*) *quadripunctata*, L., was found in the first half of July on fir stumps; the tunnels formed by the larvae were found underneath the bark of such trees.

Lepidoptera. *Lymantria* (*Psilura*) *monacha*, L., appears yearly in the forests, but serious outbreaks occur only at intervals, usually in three or four successive years. The last great outbreak occurred during 1909–1913 and was specially serious in 1912. In some forests in the government of Kurland, the young firs were damaged by the caterpillars. The remedies against the pest applied in that country consist in hand-collection of the imagines, in the destruction of the caterpillars by means of trap-belts, in facilitating the breeding of birds, which destroy the insects, by providing and putting out artificial nests, etc., and in felling the damaged trees. The author considers hand-collection to be the most effective remedy. This must be done at the beginning of outbreak years, before the moths have oviposited. When this remedy has not been applied, and some of the trees are already damaged, the felling of them is urgently recommended. The Noctuid, *Panolis flammea*, Schiff. (*piniperda*, Panz.) was found in small quantities in 1911 in a forest near Riga and attacked pines, and *Calymnia* (*Cosmia*) *trapezina*, L., greatly injured oaks in some forests in Kurland. Some of the latter caterpillars were found to be infested with Tachinid parasites.

It is stated that the haste with which this report had to be prepared, has prevented many other pests of forests from being dealt with.

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DINDON (P. J.). **Промышленная культура ранней капусты.** [Commercial cultivation of early cabbage.]—**« Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 12, December 1914, pp. 893–896.

Powdering cabbage fields with slaked lime, about 80 lb. to the acre, is recommended as a means of preventing both the appearance of a fungus, *Plasmodiophora*, and of flea-beetles, *Phyllotreta atra* and *P. undulata*, and also of the cabbage fly, *Chortophila* (*Anthomyia*) *brassicae*; this is a most effective remedy against these pests and should be applied early in the morning, when the leaves are covered with dew. Cabbages are also attacked by *Pieris brassicae*, the eggs of which should be destroyed on the leaves in June. The Noctuid moth, *Barathra* (*Mamestra*) *brassicae*, may be combated by destroying its eggs on the leaves and by powdering the plants early in the morning in calm weather with basic slag to which some Paris green is added (½ lb. of green to about 36 lb. of slag.)

Календарь Русскаго Садовода. [Russian Horticultural Calendar.] Supplement to **« Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture and Market-Gardening*], *Petrograd*, 1915, 182 pp.

The following recipes are given in this calendar—(1) Kerosene emulsions (*a*) 24 lb. of kerosene, 10 lb. of green (potash) soap and 3·6 gals. of water, prepared as follows:—Boil the water and dissolve the soap in it afterwards, gradually adding the kerosene and constantly stirring the liquid; the mixture must be dissolved in water before use; (*b*) 5 lb. of green soap, 5 lb. of kerosene, 5 lb. of linseed oil, in about 23 gallons of water (the kerosene emulsion is prepared as above after which the linseed oil is gradually added and the whole stirred); this mixture, owing to the presence of oil, cannot be easily washed off by water; (*c*) 24 lb. of soda, 65 lb. of kerosene, 50 lb. of green soap, in about 230 gallons of water; the soap and soda are dissolved separately, each in about 27 gallons of water, which are then mixed and the kerosene added and afterwards the remainder of the water. (2) Tobacco extracts, all of which must be tested before use, in order to discover whether they are harmful to the plants, in which case their strength must be reduced—(*a*) 5 lb. of tobacco extract, 6 lb. of green soap, in 24 or 25 gallons of water; the soap is dissolved first in some boiling water and the remainder of the water added, the tobacco extract being well stirred in after this; (*b*) 2½ lb. of tobacco extract, 2½ lb. of green soap, ½ lb. of soda, 2 lb. of denaturalised spirits, in about 23 gallons of water; the soap is dissolved in the spirit, the soda in water, and the two poured into a container at the same time and the extract added. (3) Arsenicals: 5¼ oz. of Paris green, ¾ lb. of wheat flour, in 27 gallons of water; a paste is prepared from the green and flour with water so that no lumps are present; (*b*) 5¼ oz. of Paris green, 1 lb. of freshly slaked lime, ½ lb. of wheat flour in 27 gallons of water. (4) Adhesives for trap-belts, etc.: (*a*) 2½ lb. of white resin, 1¼ lb. of turpentine, 1½ lb. of linseed oil, 1½ lb. of olive oil; the resin and linseed oil is melted on the fire and the other ingredients well stirred into it; (*b*) 1 lb. of gas tar, 1 lb. of fish oil.

SACHAROV (N.). **Нѣсколько данныхъ къ біологіи** *Orgyia dubia*, Tausch. [Some data on the biology of *Orgyia dubia*, Tausch.] Reprint from *Revue Russe d'Entomologie, Petrograd*, xiv, no. 4, 1914, 7 pp., 2 figs.

Orgyia dubia is common in the government of Astrachan and in other parts of South-Eastern Russia. The caterpillars breed on wild plants, mostly on wormwood in the steppes and also on *Alhagi camelorum*, Fisch. [camel thorn] and some other plants. They do not harm cultivated plants, but in case of outbreaks, as in 1911–12, they may be injurious to fodder grasses. The importance of these insects, according to Portchinsky, consists in the fact that in their eggs the larvae of parasites of *Cydia pomonella* are able to winter. Even in outbreak years, it was difficult to find the imago in the open, the reason being that the number of males is very small and that the females conceal themselves. The marked sexual differences of this moth are described. The females never leave their cocoons, and the young caterpillars, which hatch in 10–12 days, remain inside the cocoons until they have devoured the remains of their parent. Three generations occur in Astrachan and there is some difference in the size and form of the summer and autumn caterpillars. Some parasites of the caterpillars occur, but they have not yet been identified.

SCHREIBER (A. F.). **Необходимость учрежденія энтомологической станціи.** [The necessity for establishing an Entomological Station in Siberia.] **« Сибирское Сельское Хозяйство.»** [*Agriculture of Siberia*], *Tomsk*, no. 1, January 1915, pp. 17–18.

An Agricultural Congress which took place in Tomsk in the summer of 1914 declared itself in favour of the establishment of an Entomological Station, and it is here pointed out that this question is very urgent, owing to the development of agriculture in Siberia during the last 15 or 20 years. It is urged that the work of the Station should cover both West and East Siberia and that, besides the study and control of various insect pests, it must also deal with other Arthropoda affecting animals.

SACHAROV (N.). **Вредныя насѣкомыя, наблюдаемыя въ Астраханской губ. съ 1912 по 1914 годъ. Къ отчету станціи за 1914 годъ.** [The injurious insects, noticed in the govt. of Astrachan from 1912 to 1914. From the report of the Station for 1914.] Published by the Entomological Station of Astrachan, *Astrachan*, 1915, 29 pp.

A list is given of insect pests observed in Astrachan during the last three years; many of these have already been dealt with in this Review, they include :—

Arachnoidea :—*Eriophyes pyri*, Pagst., on leaves of pear and apple trees ; *E. vitis*, Land., on vines ; *Tetranychus telarius*, L., on cucumbers, melons, pumpkins, etc., and two species of *Tetranychus* which injure Crimean quinces, while the local variety does not suffer from them. *Tyroglyphus* (*Aleurobius*) *farinae*, Koch, attacks stored mustard.

The chief Orthopterous pests and their parasites have already been reported on [see this *Review* Ser. A, i, p. 534; ii, p. 716].

Thysanopterous pests included *Limothrips denticornis*, Hal., on rye, and *Haplothrips tritici*, Kurd., on wheat.

Pests amongst the Rhynchota include:—*Aelia acuminata*, L., on grain, and *Carpocoris purpureipennis*, de G., which injures mustard and has been observed to destroy Tortricid caterpillars, while *Mesocerus marginatus*, L., attacks those of *Euproctis chrysorrhoea*. *Dolycoris baccarum*, L., injures mustard and strawberries, *Codophila varia*, F., mustard, *Eurygaster maura*, L., and *E. austriacus*, Schr., grain crops, and *Eurydema ornata*, L., *E. ornata*, L., var. *dissimilis*, Fieb., *E. festiva*, L., var. *chlorotica* Horw., all occur on mustard and cabbages. The eggs of these bugs. and also those of *C. purpureipennis* are parasitised by *Aphanurus* (*Telenomus*) *eurydemae*, Vas., which is itself destroyed by *Encyrtus telenomicida*. *Tingis pyri*, Geoffr., injures fruit trees and elms, and *Poeciloscytus cognatus*, Fieb., mustard and other plants. As regards aphids, *Pemphigus bursarius*, L., occurs on poplars and *Lachnus viminalis*, Boyer, on willows in autumn, others being *Aphis crataegi*, Kalt., *Aphis pomi*, Glover, *Aphis gossypii*, Glover, *A. pyri*, Koch, *A. idaei*, Goot, *A. brassicae*, L., *Siphonophora rosae*, L., *Myzus ribis*, Buckt., *Myzus cerasi*, F., and *Hyalopterus pruni*, F. The following enemies of APHIDIDAE are reported: *Coccinella* 11-*punctata*, L., *C.* 5-*punctata*, L., *C. septempunctata*, L., *Thea* 22-*punctata*, L., *Exochomus* 4-*pustulatus*, L., *Chilocorus bipustulatus*, L., *Bulaea lichatschovi*, Hum., *Brumus* 8-*signatus*, Geb., *Propylaea* 14-*punctata*, var. *tetragonata*, Laich., *Hippodamia* 13-*punctata*, L., *Coccinella* (*Adonia*) *variegata*, Goeze, *Anisosticta* 19-*punctata*, L., *Harmonia conglobata*, L. var. *gemella*, Hbst., *Adalia bipunctata*, L., *Aphidoletes carnifex*, *Lasiophthicus* (*Syrphus*) *pyrastri*, L., *S. balteatus*, Dg., *Chrysopa perla*, L., and *Aphidius brassicae*, Motsch.

Lepidopterous pests include:—*Tineola biselliella*, Hummel, in houses; *Lithocolletis populifoliella*, Tr., on poplars; *Ornix anguliferella*, Z., injuring leaves of apple trees, there being two generations; *Hyponomeuta malinellus*, Zell.; *H. variabilis*, Zell.; *Plutella maculipennis*, Curt., (*cruciferarum*); *Ethmia* (*Psecadia*) *pusiella*, Roem.; *Coleophora hemerobiella*, Scop.; *Depressaria nervosa*, Hw., found in the inflorescence of dill and caraway [*Carum carui*]; *Sitotroga cerealella*, Oliv.; *Tortrix* (*Cacoecia*) *podana*, Sc.; *T. crataegana*, Hb.; *T. sorbiana*, Hb.; *Olethreutes* (*Argyroploce*) *variegana*, Hb.; *P. pruniana*, Hb.; *Cydia pomonella*, L.; *Eucosma* (*Tmetocera*) *ocellana*, Tr.; *Polychrosis botrana*, Schiff.; and *Cydia* (*Grapholitha*) *funebrana*, Tr., on plum and apricot. *Sciapteron tabaniforme*, Rott., injures poplar trees, *Aegeria* (*Sesia*) *tipuliformis*, currants and gooseberries, *Aegeria* (*Sesia*) *myopaeformis*, Borkh., apple and pear, *Cossus cossus*, L., apple, willow and poplar, and *Zeuzera pyrina*, L., only apple and lilac. The imagines of *Pyralis farinalis*, L., are frequently found in houses and stores. *Phlyctaenodes sticticalis*, L., appears yearly and a large outbreak occurred in 1912, when the following parasites were reared from it:—BRACONIDAE: *Microtipus sacharovi*, Kok., *Agatis longicauda*, Kok., *Apanteles ruficrus*, Halid.; ICHNEUMONIDAE: *Omorgus lugubrinus*, Halm., *Angitia chlorosticta*, Gmel., *Labrorychus debilis*, Wesm., var *phlyctaenodis*, Kok., and *Cremastus ornatus*, Szép.; as well as the Tachinids, *Zenillia pullata*, Meig., (*Tritochaeta polleniella*

Rond.) and *Nemorilla maculosa*, Mg. Besides these parasites, large numbers of larvae and adults of *Calosoma investigator* and *Calosoma denticolle* were observed in 1912 destroying the caterpillars of *P. sticticalis*. The caterpillars of *Plodia interpunctella*, Hb., attack dried fruits in stores. *Homoeosoma nebulella*, Hb., attacks sunflower seeds, but in 1913, in the district of Zarev, only the early sowings were injured. *Talis quercella*, Schiff., was not injurious until 1913, when an outbreak of its caterpillars occurred, which destroyed all graminaceous plants on the steppes over about 1,350 acres, as well as some wheat crops. Other Lepidopterous pests were :—*Aporia crataegi*, L., *Vanessa polychloros*, L., the Pyralid, *Evergestis* (*Orobena*) *extimalis*, L., which breeds on mustard, radish, turnips and cabbage ; *Eriogaster* (*Lasiocampa*) *lanestris*, L., *Malacosoma* (*Lasiocampa*) *castrensis*, L., *M. neustria*, L., *Gastropacha quercifolia*, L. and *Odonestis pruni*, L., mainly on apple trees. *Dicranura* (*Harpia*) *vinula*, L., was found on poplars and willows in nearly all the districts and on *Populus nigra*, L., on the islands of the Volga ; *Phalera bucephala*, L., caterpillars on apple trees near Astrachan ; *Pergesa* (*Chaerocampa*) *elpenor* L., and *Delilephila lineata*, L., on vine ; *Biston hirtarius*, Cl., *Abraxas grossulariata*, L., *Lymantria* (*Ocneria*) *dispar*, L., mostly in the northern parts of the government and rarely in the southern ones ; *Stilpnotia* (*Leucoma*) *salicis*, injures poplars in the south. *Euproctis chrysorrhoea*, L., attacks quinces ; *Orgyia dubia*, Tausch., is not injurious to cultivated plants, but in years of outbreaks, as in 1911, devours various steppe plants serving as food for cattle ; *Phytometra* (*Plusia*) *gamma*, L., injures mustard and also cabbages ; *Acronycta tridens*, Schiff., apple, cherry, pear and plum ; *Acronycta psi*, L. ; *Calymnia trapezina*, L., and *Eupsilia* (*Scopelosoma*) *satellitia*, L., on apples ; *Laphygma* (*Caradrina*) *exigua*, Hb., has been rare in recent years, but was formerly very injurious to tomatoes. *Euxoa* (*Agrotis*) *segetum*, Schiff., and *Feltia* (*Agrotis*) *exclamationis*, L., injure bachza plants throughout the government. Complaints have been received of the caterpillars of *Arctia spectabilis*, Tausch., damaging onions.

Coleopterous pests include the Elaterids, *Dicerca berolinensis*, Herbst, on Lombardy poplars ; *Agriotes lineatus*, L., *Melanotus rufipes*, Hbst., *Cardiophorus rufipes*, Geoff., and *C. discicollis*, Hbst., on apple and pear trees. *Lytta vesicatoria*, L., attacks poplars, lilac and ash ; *Epicauta erythrocephala*, Pall., potatoes ; *Henicopus hirtus*, L., and *H. pilosus*, Scop., ears of grain ; *Pedinus femoralis*, L., *Opatrum sabulosum*, L., and *Gonocephalum* (*Opatrum*) *pusillum*, F., all three injure bachza and market-garden plants ; *Tentyria nomas*, Pall., injures melons and other Cucurbitaceae ; *Tenebrio molitor*, L., and *Tribolium confusum*, Dub., stored grain. *Plagionotus arcuatus*, L., attacks oaks, *Acanthoderes varius*, F., poplars, and *Haplocnemia myops*, Dalm., apple trees. *Tetrops praeusta*, L., *Rhopalopus clavipes*, F., and *Prionus asiaticus*, Fald., occur in orchards. *Crioceris* (*Lema*) *duodecimpunctata*, L., *C. asparagi*, L., and *Exosoma collaris*, Hum., all injure asparagus. *Labidostomis longimana*, L., and *L. pallidipennis*, Germ., attack ears of corn. *Colaphus sophiae*, Schall., *Entomoscelis adonidis*, Pall., *E. sacra*, L., (*dorsalis* F.), all attack mustard. *Galerucella tenella*, L., injures strawberries and *G. luteola*, Mull., (*xanthomelaena*, Schr.) elms. *Luperus longicornis*, F., injures the foliage of apple, cherry, pear, poplar and other trees. *Psylliodes*

attenuata, Koch, occurs on hops and wild hemp, and *Chaetocnema concinna*, Marsh., on beets. *Aphthona euphorbiae*, Schr., was taken on mustard and evidently feeds on other plants, as no linseed is cultivated in the district; *P. deyrollei*, Tourn., attack apples and pears; and *Chlorophanus graminicola*, Gyl., injures leaves of *Populus nigra* and basket-willows on the islands of the Volga. The larvae of *Lixus ascanii*, L., var. *albomarginatus*, Boh., injure the roots of mustard. *Lepyrus palustris*, Scop., injures the leaves and young shoots of basket-willows. *Hylobius abietis*, L. ordinarily a pest of conifers, is found in the district of Saratov and elsewhere, though no conifers occur. *Dorytomus longimanus*, Forst., injures poplars, mostly *Populus nigra*. *Anthonomus rectirostris*, L., is found on blossoms of bird-cherries and *Rhamphus pulicarius* is reported for the first time as a pest, on young leaves of apples and pears. Other harmful weevils are:—*Byctiscus betulae*, L. (*Rhynchites betuleti*, F.), *Rhynchites auratus*, Scop., *R. bacchus*, L., *R. pauxillus*, Germ., *R. aequatus*, L., and *Attelabus curculionoides*, L. *Scolytus* (*Eccoptogaster*) *rugulosus*, Ratz., and *S. pruni*, Ratz., are both found all over the whole government injuring fruit trees, especially in old orchards.

The larvae of *Polyphylla alba*, Pall., frequently injure orchards; *Hoplia parvula*, Kyrn., and *Anomala aenea*, de G., eat the leaves of basket-willows; *Anisoplia segetum*, Hbst., *A. cyathigera*, Scop., *A. brenskii*, Reitt., are all found on grain; the larvae of *Pentodon idiota*, Hbst., (*P. monodon*, F.) feed on the roots of vines; *Epicometis* (*Tropinota*) *hirta*, P., is specially injurious to orchards in the south, although outbreaks occur also in the north; *Oxythyrea funesta*, Poda, (*stictica*, L.) does damage in gardens and *Cetonia aurata*, L., attacks fruit trees.

Dipterous pests include:—*Pegomyia hyoscyami*, Panz., on beets; *Chortophila brassicae*, Bché., on cabbages. *Phytomyza orobanchiae* feeds on the fungi *Orobanchia cumana* and *O. ramosa*. An enormous outbreak of *Bibio marci*, L., and *Bibio hortulanus*, L., occurred in 1913. The author differs from Prof. Cholodkovsky, who states that the larvae of these insects feed on the thin rootlets of various plants, as he has never observed such damage and considers them harmless.

HYMENOPTERA: *Pteronus ribesii* (*Nematus ventricosus*, K.) and *Pristiphora pallipes*, Lep., (*N. appendiculatus*, Hart.), both injure gooseberries and currants. *Athalia spinarum*, F., injures mustard; *Eriocampoides limacina*, L., (*Selandria adumbrata*, Klug) is found during the whole summer in all districts on the leaves of cherries and plums; *Eurytoma amygdali* is widespread on plums. Ants are injurious in that their nests interfere with the proper watering of orchards and market-gardens. The local farmers control them by means of bottles filled with salt water and half sunk into the earth inclined in such a way that their necks touch the bark of the trees.

The distribution of the principal pests of orchards over various parts of the government, which is divided for the purpose into 7 districts, is given, many of the above-mentioned pests being dealt with.

Главнѣйшіе вопросы, поступившіе въ Центральную Фитопатологическую Станцію за 1913 годъ. [The principal queries received at the Central Phytopathological Station in 1913.]—**«Болѣзни Растеній.»** [*Diseases of Plants*], *Petrograd*, viii, no. 2-3, 1914, pp. 89–107.

This is a list of queries addressed to the Station during 1913 and of some of the remedies suggested in reply. Apricots were attacked at the roots by larvae of *Anoxia pilosa*, F. Poisoning the soil with carbon bisulphide, Paris green and iron sulphate, covering the soil with straw during the time the beetles are on the wing, and catching and killing the adults, were advised. The leaves were attacked by *Tetranychus telarius*, L., against which repeated dusting with flowers of sulphur or spraying with soapy water (10 lb. of soap in 27 gallons of water), and in autumn, collection and burning of the fallen leaves, and brushing with an oiled rag the bottoms of the trunks and the forks of the branches where the mites winter, were recommended. Oranges were damaged by *Lepidosaphes pinnaeformis*, *Chrysomphalus dictyospermi* and *Tetranychus pilosus*, the usual remedies being suggested. Birches were infested with *Scolytus* (*Eccoptogaster*) *ratzeburgi*; remedies: felling of the damaged trees and burning their bark; trap trees. Vine roots were damaged by *Polyphylla fullo*, L.; preventive remedies consist in burying naphthalin in the soil, during the oviposition period. Cherry leaves were skeletonised by the sawfly, *Eriocampoides limacina* (*Selandria adumbrata*), against which, spraying with insecticides and turning over the soil is suggested; and against *Myzus cerasi* spraying with kerosene emulsion is recommended. On elms, galls on the leaves were caused by *Pemphigus pallidus* and *Schizoneura lanuginosa*; spraying with soapy water or washing the trunks with 2 per cent. copper sulphate was advised. Blueberries were infested with *Chionaspis salicis*. Pear trees were injured by *Aphis pyri*—remedies: spraying with kerosene emulsion, tobacco extract, and quassia decoction; by *Psylla pyricola*—remedies: three sprayings with kerosene emulsion or tobacco powder in water ($2\frac{1}{2}$ lb. of tobacco in 27 gallons of water); fumigation with tobacco smoke; *Tingis pyri*—remedies: repeated sprayings with kerosene emulsion; *Eriophyes pyri*, Pagst.—remedies: the collection and destruction of the damaged leaves; in March, spraying with kerosene emulsion. Blossoms were attacked by adults of the Elaterid, *Limonius minutus*, L.; remedies: the collection and destruction of the beetles. Willow trees suffered from the galls of the Cecidomyids, *Rhabdophaga heterobia*, Lw., and *R. clavifex*, Kieff., and the leaves were injured by *Galeruca* (*Adimonia*) *capreae*. Clover blossoms were attacked by *Anthothrips aculeatus*, and by *Apion apricans*. Gooseberries were injured by larvae of *Aegeria* (*Sesia*) *tipuliformis*, and raspberries by *Bembecia hylaeiformis* and *Byturus fumatus*. Lemons were attacked by *Tetranychus pilosus*, *Lepidosaphes pinnaeformis* and *Chrysomphalus dictyospermi*.

In larch trees, the needles were infested with larvae of *Coleophora laricella*. The young shoots of silver fir, *Picea pectinata*, were attacked by caterpillars of *Enarmonia* (*Grapholitha*) *rufimitrana*, H.S., and the needles damaged by *Dreyfusia pectinatae*, Chldk.; remedies: cutting and burning of the heavily infested shoots, spraying with kerosene

emulsion. *Abies concolor* (American silver fir), suffered from the galls of *Eriophyes pini*, Nal. var. *floricola*, Trott. The leaves of lilacs were injured by *Gracilaria syringella*, F.; plum and currants by *Pteronus ribesii* (*Nematus ventricosus*), and *Myzus ribis*, and black currants by larvae of *Incurvaria* (*Tinea*) *capitella*, while *Ribes alpinum* leaves were injured by *Eriophyes scaber*, Nal. Poplar trees were damaged by galls of *Pemphigus bursarius*, L., and by *Chaitophorus populi*, L. Apple trees were injured by *Psylla mali*, *P. pyricola*, *Schizoneura lanigera*, *Aphis pomi*, *Cydia pomonella*, *Hyponomeuta malinellus*, *Coleophora hemerobiella*, *Lyonetia clerkella*, *Anthonomus pomorum*, *Rhynchites pauxillus*, *R. auratus*, *Limonius minutus*, and *Lepidosaphes ulmi*.

VITKOVSKY (N.). **Вредители и болѣзни растенiй, наблюдавшiеся въ теченiе 1913 года въ Бессарабской губернiи.** [Pests and diseases of plants, observed during 1913 in the government of Bessarabia.] Reprint from **«Труды Бессарабскаго Общества Естествоиспытателей.** [*Memoirs of the Bessarabian Society of Naturalists*], *Kishinev*, 1914, 43 pp.

In the spring of 1913, serious outbreaks of *Aporia crataegi*, *Hyponomeuta malinellus*, *H. variabilis* and also of an unidentified Lepidopterous pest occurred in Bessarabia. The caterpillars of the last-named appeared in the middle of April, and it was thought that they hatched on oak and elm trees and, having defoliated these, passed on to the adjoining orchards, where they attacked chiefly apple and plum, less frequently pears, and to a still less degree, quinces.

Amongst Lepidopterous pests, *Cydia pomonella*, L., was one of the chief. The moths were on the wing after the 10th May, the caterpillars of the next generation pupating in the first half of July, while those of the second began to prepare to hibernate in the first half of of October. Recently, the bag treatment is gradually being adopted, the bags being made from parchment paper at a cost of 6s. 8d. for 1,000 trees. This treatment leads to an increase in the weight of the individual fruits, if bags of a particular colour, differing for various fruits, are used. According to Liubimenko, this is to be attributed to the influence of light on the development, shading from direct sunlight producing heavier and better quality fruit. *Cydia* (*Grapholitha*) *funebrana*, Tr., and *Cydia* (*Carpocapsa*) *putaminana*, Stgr., were not found in large numbers. *Aporia crataegi*, L., totally defoliated plum, apple and pear trees in many localities, but apparently apricot and cherry are less frequently attacked. The caterpillars of the second generation were more numerous than those of the hibernating one, but about 42 per cent. of the pupae perished from fungus diseases and parasites, the most common amongst the latter being *Pimpla instigator*, F.

Hyponomeuta malinellus and *H. variabilis* appeared in enormous numbers, the latter attacking only plums. According to some authors, outbreaks of *H. malinellus* are controlled by the amount of moisture and rain, dry weather being the most favourable to their multiplication, but the author's observations during the last three years, prove directly the opposite, *viz.*, that wet years assist the increase of this

pest. He is inclined to attribute this to the adverse influence of rainy weather on the parasites, which are the chief controlling agency. *Vanessa polychloros*, L., defoliated pear, plum and cherry trees near Kishinev. *Chloroclystis rectangulata*, L., injured buds of pear and apple trees in one locality, not having been previously reported as a pest in the government of Bessarabia; the injury is similar to that caused by *Anthonomus pomorum*, L. *Cossus cossus*, L., occurs everywhere, more or less considerable damage from its caterpillars having been observed in some old orchards. *Tortrix* (*Pandemis*) *ribeana*, Hb., occurred on walnuts near Akkerman; *Trichiura crataegi*, L., on plums; *Orgyia gonostigma*, F., on pears; *Episema* (*Diloba*) *caeruleocephala*, L., on apples; *Abraxas grossulariata*, L., on currants; *Lymantria dispar*, L.; *Zeuzera pyrina*, L.; *Cheimatobia brumata*, L.; and *Saturnia pyri*, Schiff. *Phlyctaenodes sticticalis*, L., attacked fruit trees and even walnuts, mulberry trees and white acacia. *Papilio podalirius*, L., injured apricot and pear trees.

Coleopterous pest included: *Anthonomus pyri*, Boh., noticed for the first time in large numbers in Bessarabia; *Sciaphobus* (*Sciaphilus*) *squalidus*, F., some observations on which, confirmed the statements of Znamensky [see this *Review*, Ser. A, ii, p. 337] that this pest has a biennial cycle of development, the larvae feeding on roots; *Anthonomus pomorum*, L., *Rhynchites pauxillus*, Germ., *R. aequatus*, L., *R. bacchus*, L., *Byctiscus betulae*, L. (*R. betuleti*, F.), *Peritelus griseus*, L.; *Melolontha melolontha*, L., chiefly injurious in the imago stage to fruit trees, particularly in orchards situated near forests; *Epicometis hirta*, Poda, and *Lytta vesicatoria*, L., which devoured leaves of ash and lilac trees.

Of Hymenopterous pests, the most injurious belonged to the TENTHREDINIDAE, including:—*Hoplocampa fulvicornis*, Klug, the larvae of which pupate in the ground during the first half of June; the larvae of *H. brevis*, Klug, are about ten days earlier; *H. testudinea*, Klug, observed to attack preferably *Pyrus cerasiformis*; *Eriocampoides limacina* (*Eriocampa adumbrata*, Klug); *Pamphilus* (*Lyda*) *nemoralis*, L., the larvae of which were found at the end of May on peach trees, living inside rolled leaves drawn together with a web; *Pristiphora pallipes*, Lep. (*Nematus appendiculatus*, Hart.), which appeared at the end of March and began at once to oviposit on young leaves of gooseberries, producing 3–4 generations during the year, and *Clavellaria amerinae*, L., observed on willows in river valleys. Of the family CYNIPIDAE, *Andricus fecundatrix*, Htg., *Cynips kollari*, Hart., and *Neuroterus numismalis*, Hart., were noticed on oaks, and *Rhodites rosae* on roses.

Rhynchota. The chief Coccid pests were: *Eulecanium* (*Lecanium*) *cerasi*, Goethe. *Eulecanium* (*Physokermes*) *coryli*, L., was the chief pest of plums. It is found in the Bessarabian Bukovina and in many other districts, but the chief plum-growing district—Kodry—is still free from it, although it is expected that it may spread there. The larvae of this pest mostly occur on the leaves and return to the trunks when they fall. Trees infested were observed to lose their leaves later than healthy ones. *Eulecanium* (*Lecanium*) *robiniarum*, Dougl., is widespread in north and south Bessarabia, injuring *Robinia* trees, and as it migrates from them on to plum or mulberry trees, it threatens both the local beekeeping and silk-growing industries. *Aspidiotus ostreaeformis*, Curt., is the chief pest of pear trees and is

spreading over new areas; an allied species attacks French plums. *Lepidosaphes ulmi* is found in large numbers on apple trees in several localities. *Psylla pyricola*, Forster, is found everywhere in central and south Bessarabia, while *P. mali*, Forst., has been reported only from the district of Chotin.

Schizoneura lanigera, Hausm., although known to occur in the government for the last 25 or 30 years, has only lately been included among the local pests; *A. pomi*, De Geer, *Hyalopterus pruni*, F., and *Aphis pyri*, Koch, are found everywhere; *Lachnus juglandicola*, Kalt., has been noticed on walnuts near Kishinev; *Schizoneura lanuginosa*, Hart., on elm trees, particularly in the steppe districts. *Aphis tiliae*, L., has seriously injured lime trees in Kishinev, causing the leaves to turn yellow and drop in the middle of summer. *Eriophyes* (*Phytoptus*) *pyri*, Pagst., was noticed on pear trees and *E. tristriatus*, Nal., on walnuts.

As regards vine pests, *Clysia ambiguella* appeared in large numbers, which is attributed to the rainy summers of 1911 and 1912, a hot dry summer being inimical to the development of this pest. The frequent appearance of *Sclerotinia fuckeliana*, Fuck., on the variety of vine "Camé [Gamay ?] hâtif des Vosges," when cultivated in Bessarabia, is attributed to the influence of *C. ambiguella*, as the spores of this fungus penetrate through wounds caused by insects or mechanical means. *Sparganothis* (*Oenophthira*) *pilleriana*, Schiff., was found only in the southern part of the Akkerman district, where also caterpillars of *Phlyctaenodes sticticalis*, having devoured all the weeds in the vineyards, attacked the vines, concentrating on the young leaves at the tips of the shoots. *Amphimallus solstitialis*, L., and *Polyphylla fullo*, L., injure vines on steppe ground. Larvae of *Agriotes lineatus*, L., and *Athous niger*, L., are common pests of vine. *Lethrus apterus*, Laxm., injured young vine shoots near uncultivated land or highroads; *Sciaphobus* (*Sciaphilus*) *squalidus*, F., usually injures vine buds; *Eriophyes* (*Phytoptus*) *vitis* and *Phylloxera vastatrix*, Planc., are found everywhere.

The following pests of field crops are reported: *Mayetiola destructor*, Say, and *Oscinella frit*, L., were not numerous, but in some localities the damage by one or the other of these pests was great. *Anisoplia austriaca*, Hbst., was present in large numbers in south Bessarabia; *Lema melanopa*, L., was observed in many localities injuring barley and oats. *Euxoa* (*Agrotis*) *segetum*, Schiff., is not often injurious in Bessarabia, but in the autumn of 1913 it destroyed some 190 acres of crops near Kishinev and was also reported from another district. *Phlyctaenodes sticticalis*, L., in the Akkerman district, damaged various field crops to which it migrates from weeds and was apparently the most dangerous pest of maize. Other pests noticed on maize were: *Pyrausta nubilalis*, Hb., which seems to have adapted itself to maize, as the hibernating caterpillars only begin to pupate in the first half of June, so that the imago appears at the end of that month, when maize has already produced stems of fairly large dimensions, on which the females oviposit; and larvae of the following beetles, *Melolontha melolontha*, L., *Amphimallus solstitialis*, L., *Agriotes lineatus*, L., *Athous niger*, L., *Omophlus lepturoides*, F., *Opatrum sabulosum*, L., and *Pedinus femoralis*, L. An extensive outbreak of *Tetraneura rubra*, Licht., occurred in middle and south Bessarabia; this aphid appears in spring on elm

trees and inhabits red, irregular swellings on the leaves, from which winged forms emerge in June. These are viviparous and their desendants live on grasses and maize. During the summer only wingless forms occur, but in autumn winged individuals appear, which return to elms and produce sexual forms. These oviposit in cracks and holes in the bark, the eggs remaining over the winter. *Tetraneura ulmi*, de G., has a similar life-history, the galls it produces being green, oval and situated on short stems.

Winter rape was attacked everywhere by *Entomoscelis adonidis*, Pall., and by *Aphis brassicae*, L., while clover was damaged by *Apion apricans*, Hbst. Market-garden crops were injured by *Aphis gossypii*, Glov., which seriously damaged cucumbers and melons in places.

Труды Кіевской Станціи по борьбѣ съ вредителями растеній при Южно-Русск. Общ. Поощр. Земл. и Сельск. Промышл. [*Studies from the Riev Station of the South Russian Agricultural Syndicate for the control of pests of plants*], *Petrograd*, iii, 1914, 36 pp.

The following three articles appear in this volume:—

SHISHKIN (K.). **Наблюденія надъ превращеніемъ сосноваго шелкопряда.** [Observations on the metamorphosis of *Dendrolimus pini*, L.] pp. 3–17.

A short account is given of the biology of *Dendrolimus pini*, L., based on observations made during 1910, 1911 and 1912 on caterpillars and pupae collected in the Zabolotchinsk Forest of the government of Poltava. When the author visited the forest on 30th June 1910, very few imagines could be seen, though a female was found from which eggs were obtained. In the laboratory, the imagines emerged between the 31st May and 5th August, the first imago in the open being found on 23rd May. The statement by Seitz that female caterpillars of *Orgyia antiqua* moult once more than the males is referred to, but in this case the opposite was noticed. The caterpillars winter in the 3rd, 4th or 5th stage. One individual moulted 8 times, hibernated for a second time, pupated in April and produced a female in May. Caterpillars hatched from eggs laid by one and the same female have a greatly varied duration of moulting periods, etc.

ZVIEREZOMB-ZUBKOVSKY (E. V.). **Златка** *Agrilus hastulifer*, **Ratzeb. Образъ жизни и борьба съ ней.** [*Agrilus hastulifer* Ratz.; its life-history and control.] pp. 19–23, 5 figs.

Agrilus hastulifer, Ratz., was first reported as a forest pest in the government of Kiev in 1905 and since then it has done considerable damage every year to the forests of that government and of South-Western Russia generally, chiefly attacking oak and hornbeam. The beetles, which are described and figured, are mostly found in sunny places. The females oviposit on healthy trees in places exposed to the sun, the eggs being laid in cracks, etc., of the bark. The larvae, which are described and figured, mine into the bark and wood. The insects winter in oval cocoons, at the end of the mines,

some in the larval stage, pupating in spring and producing imagines in summer; others in the pupal stage, the imagines appearing at the beginning of summer; while a small number winter as imagines, which are on the wing at the end of May. The parasites of this pest which have been reared are the Chalcids :—*Metapelma spectabilis*, Westw., and *Pteromalus flavipes*, Kurd. The branches weakened by *A. hastulifer* are usually attacked later by other beetles, such as *Scolytus* (*Eccoptogaster*) *carpini*, Ratz., and species of *Clytus*. The felling and barking of the affected trees or the cutting and burning of the single branches are recommended, the latter procedure being more satisfactory when the insects are in their pupal stage. In summer, during the time the insects are on the wing, trap trees are recommended and have been successfully employed by the Kiev station. For this purpose, a belt of bark about 7 inches wide is removed from some trees, on which the insects congregate and the trees are then felled and barked before the larvae have made their cocoons, the resulting waste being burned. In nurseries, the smearing of the bark with a mixture of 2 parts of clay, 1 part of lime and 1 part of cow-dung or joiners' glue is recommended.

Zvierezomb-Zubkovsky (E. V.). **Опыты борьбы съ личинками майскаго жука посредствомъ сѣрнистаго углерода.** [Experiments on controlling larvae of *Melolontha* by means of carbon bi-sulphide], pp. 25–35.

Experiments on controlling larvae of *Melolontha melolontha*, L., and of *M. hippocastani*, L., by means of carbon bisulphide in the fruit nursery of the Vasilkovsk Forest of the government of Kiev, are described. Digging operations undertaken in various parts of the nursery, having different degrees of light and shade, a different natural and artificial soil, etc., showed an average presence of 16 larvae in about 5½ square feet, while in the adjoining woods only 2 or 3 larvae were found in the same area. This is explained by the fact that the light sandy soil of the nursery, situated in an exposed place and possessing sufficient moisture, provided the optimum conditions necessary for the development of the insects. A total of 191 larvae were collected in 12 holes, each 28″ by 28″ by 28″ and the diggings showed that at the beginning of May the larvae were more or less equally distributed over various depths, in the middle of May they predominated at a depth of 14 inches, and after the end of May, at a depth of 7 inches; at the beginning of August, single pupae were found at a depth of 16–19 inches. An adult *M. hippocastani* was found on 26th August, while after 7th September the number of beetles was greater than that of pupae. Besides larvae of *Melolontha*, there were also found larvae of *Anomala aenea*, de G., *Phyllopertha horticola*, L., and of some other Scarabaeidae. *M. melolontha* and *M. hippocastani* were present in about equal numbers in the forest, the latter being found earlier (10th May) while the former only appeared after 18th May and occurred exclusively after the 23rd May. The experiments on injecting carbon bisulphide into the soil by means of an injector showed that a dose of 4 grms. injected to a depth of 3 or 4 inches produced only 8 per cent. of stupified larvae, that the same amount injected to a depth of 5 or 6 inches produced 15 per cent.,

but that a dose of 5–7 grams to a depth of 6 or 7 inches destroys all the larvae, 35 grams being sufficient for an area of 5½ sq. feet. The stupified larvae died in 1 or 2 days. The injections were performed with the "Kober" injector, which is described and figured. Instead of injecting the carbon bisulphide, small balls of cotton wool soaked in it may be buried in the earth by means of a dibble about 2 inches thick, with a cross bar 6–7 inches from the end; the balls should be about the size of a walnut; in order to facilitate the making of them some tar is added to the cotton wool. The balls are kept in a tightly closed bottle filled with CS_2 and are quickly removed from the bottle and placed in the hole by means of a special hook.

VITKOVSKY (N.). **Червь, повреждающій озимые всходы.** [A caterpillar injuring sprouts of winter-sown crops.] – **«Южное Хозяйство.»** [*Southern Husbandry*], *Alexandrovsk*, no. 1, 28th January 1915, pp. 14–21, 5 figs.

Up to 1914, the caterpillars of *Euxoa segetum*, Schiff., the most dangerous pest of winter-sown crops, were not much in evidence in the government of Ekaterinoslav, but during that year they appeared in various parts of it and did great damage. These cutworms threaten to be as serious a pest in the near future as is *Oria* (*Tapinostola*) *musculosa* to summer-sown crops. A popular account of the pest is given, with descriptions and figures of its various stages. The destruction of weeds, on which the oviposition takes place, and the use of black fallow and occupied fallows are advised [see the *Review*, Ser. A. ii, p. 316]. Against the caterpillars, trenches round the fields to be protected are recommended.

Труды Перваго Всероссійскаго Съѣзда дѣятелей по Прикладной Энтомологіи въ г. Кіевѣ въ 1913 году. [The Work of the first All-Russian Congress of Economic Entomologists in Kiev, in 1913.] *Kiev*, 1915, 330 pp.

The following 22 papers were read and discussed at the Congress:—

AVERIN (V. G.). **Обзоръ дѣятельности Харьковскаго Энтомологическаго Бюро за время его существованія (1905 1913).** [A Review of the Work of the Charkov Entomological Bureau for the time of its existence (1905–1913).] pp. 11–24.

In this prefatory article, the history of the Entomological Bureau of Charkov is traced. Great outbreaks of wheat chafers (*Anisoplia austriaca*, Herbst), locusts and the Hessian fly in the South Russian steppes led to the establishment of an Entomological Commission by the Zemstvo of Charkov in 1878 and by that of Odessa in 1882. In accordance with the recommendation of the Entomological Congress held in Odessa in 1887, an Entomologist was appointed by the authorities concerned, for the whole of South Russia. The Zemstvo of Taurida was the first to establish in 1893 a special Entomological organisation. In Charkov, the same took place in 1905, as a direct result of great damage to crops done by a species of *Eurygaster*. The chief object of the Bureau is the organisation of campaigns against

insect pests and the instruction of the population in the use of various remedies, while scientific studies and researches are conducted in connection with pests which have a special importance. The Bureau has also conducted a campaign against the rodent, *Spermophilus citellus*, which has been proved to be a carrier of plague, and as such, is particularly dangerous in the eastern part of the government, adjoining the province of the Don. Owing to the great importance of these rodents, the author urges the necessity of the Zemstvos and the Central Government undertaking a campaign against them; the latter has already assigned £100,000 for this purpose, while many Zemstvos have also created special funds for the same object.

ANDREIEVA (N. V.) & KURDJUMOV (N. V.). **Вліяніе поврежденія яровыхъ хлѣбовъ шведской мушкой и яровой мухой на ростъ и урожай растеній.** [The effect of the injuries to summer-sown crops by the Swedish fly (*Oscinella frit*) and by *Chortophila genitalis*, Schnabl, on the growth and yield of the plants.] pp. 25–36.

The investigations described in this paper were conducted during the summer of 1913 at the Experimental Station of Poltava. The Frit fly winters in the larval stage and usually appears late in summer when the summer-sown crops begin to tiller. The females oviposit mostly on young stems and therefore never injure the main shoot of grain sown at a normal time, but only the later side-shoots. Oviposition is usually effected on strong plants, such as tiller freely and for a longer time, thus providing more young stems suitable for that process. The life-history of *Chortophila* (*Adia*) *genitalis* is different, there being only one generation yearly. It winters in the pupal stage and appears with the first warm days in spring; thus when the shoots of summer-sown wheat appear, on which the larvae feed, the flies are already in the fields and are able to complete their oviposition before the wheat begins to tiller. Therefore only the main stem of each plant is infested. The nature of the injury is the same as that caused by *Oscinella* (*Oscinis*) *frit*. The results of a comparative investigation of plants damaged by each of these pests and of healthy plants are described. The sample plants for these investigations were taken from the same fields and as far as possible amongst plants situated close to each other. The results are shown in tables, containing figures relating to 50 plants of summer-sown wheat infested by *C. genitalis* at the time the stems become hollow, and 50 healthy plants, samples of both having been taken on 14th May. The infested plants showed a tillering increased by 10·1 per cent. as compared with the healthy ones, the later side-shoots having increased by 67·1 per cent.; the average length of the stems was 15·3 per cent. less; the weight of the green plants was 17·8 per cent. less, and that of the dried ones 18·5 per cent. Another table deals in the same way with infested and healthy plants of summer-sown wheat taken when they were coming into ear, and the results show that the tillering of the infested plants had decreased by 8·9 per cent.; the number of plants producing ears had decreased by 32·6 per cent.; the average length of the stems was 11 per cent. less; the weight of the green

plants 14·4 per cent. and that of the dried ones 12·2 per cent. less. The investigations were repeated with plants taken when ripening, and it was found that the number of grains in the ears of the damaged plants was 15·5 per cent. less than in the ears of healthy ones, and that the absolute weight was 3·4 per cent. less; the number of ears was also less, owing to the absence of three-eared plants, and the smaller number of two-eared ones. The ripening of the grain of the damaged plants is delayed as compared with the healthy ones, which is due to the fact that only the later stems are able to yield grain, the earlier ones being destroyed. It is concluded that the injury by *C. genitalis* decreases the harvest of summer-sown wheat by about 40 per cent., which figure is called the "coefficient of injury" of these insects.

Only the later samples showed injury due to *Oscinella frit*. Healthy, but infested plants compared with uninfested ones showed an increase in tillering of 17·6 per cent., an increase in the average length of the stem of 1·5 per cent., an increase in the weight of the green plant of 12·6 per cent., and an increase in the weight of air-dried plants of 14·5 per cent.; the plants infested by both insects showed in comparison with those infested by *C. genitalis* only, an increase in tillering of 0·9 per cent., an increase in the average length of the stems of 6·2 per cent., an increase of the weight of the green plants of 8·2 per cent., and the dried ones of 11 per cent.

Similar effects by *O. frit* on samples of barley, which is not injured by *C. genitalis*, are illustrated by tables. Samples of barley taken during the harvest showed that the plants injured by this pest exhibit an increase in the green weight and in the number of two-eared and three-eared plants. The absolute weight of the grains of injured plants had somewhat decreased, but this may be due to the more profuse tillering and to the later ripening.

It is concluded that the Frit fly does not cause any serious changes in the attacked plants, at least in the case of summer crops, sown at a normal time. In the case of late-sown crops, the Frit fly infests the first stem and the results on the plants are the same as those caused by *C. genitalis*. When the crops are sown at the normal time, the insect breeds on the side-shoots, mostly on that part of them which appears later. Thus there is sufficient material for the insect to breed without injuring the plant and its yield. Both in the case of summer-sown wheat and of barley, about 40 per cent. of the side-shoots perish when infested by Frit fly, thus increasing the vigour of the main stem. This fly, while injuring the side-shoots, has the same effect as a gardener who pinches the shoots and thus directs the juices of the plants towards the formation of fruit. If that is so, this insect, when attacking summer-sown crops to a degree not exceeding 40 per cent., may possibly be regarded as a useful insect. Further researches are, however, required to confirm these conclusions.

During the discussion, Professor N. Kulagin pointed out that the tillering of barley depends also on the local meterological conditions; S. Soloviev reported that the Frit fly is very injurious in the Government of Petrograd, where it appears on early crops in the second half of April; A. Silantiev and A. Baranov recorded that in Northern Russia this insect attacks the main stem of the plant and

thus is very injurious ; in reply to a question by N. Kulagin, the author stated that the insect winters in the third, very seldom in the second larval stage.

Borodin (D. N.). **Вопросъ о бактеріальномъ методѣ борьбы съ саранчей.** [On the question of the bacteriological method of controlling of locusts.] pp. 37–46.

The subject was dealt with on much the same lines as in a previous paper [see this *Review*, Series A, ii, p. 353] and after a discussion, during which it was pointed out that the advocacy of this method has done much harm in creating a popular opposition against the chemical method, the Congress adopted a resolution pointing out the insufficient state of our knowledge on this subject and the desirability of further and more thorough researches.

Vassiliev (E. M.). **Къ вопросу о біологіи лугового мотылька.** [On the question of the biology of *Phlyctaenodes sticticalis*.] pp. 47–51. [See this *Review*, Ser. A, ii, p. 465.]

During the discussion, V. Averin pointed out that the caterpillars of *P. sticticalis* are also known to have attacked cultivated Graminaceae. N. Sacharov reported that, in the government of Astrachan, this pest has three generations, some of the caterpillars also passing into a stage of diapuse ; the author, in agreement with Averin, recommended the control of this insect by smudge fires and troughs containing molasses, as well as by digging the soil in order to disturb the pupae.

Vassiliev (E. M.). **Къ вопросу о біологіи нѣкоторыхъ щелгуновъ.** [On the question of the biology of some species of Elateridae.] pp. 52–57. [See this *Review*, Ser. A, ii, p. 466.]

During the discussion, the author replying to V. Plotnikov, said that he has never succeeded in rearing imagines from the larvae ; A. Baranov reported that, in the government of Moscow, the pupae of these pests are observed in June.

Vassiliev (E. M.). **Къ біологіи свекловичной мухи и къ вопросу о борьбѣ съ нею.** [On the biology of *Pegomyia hyoscyami*, Panz., and on the question of controlling it.] pp. 58 60. [See this *Review*, Ser. A, ii, p. 467.]

During the discussion, N. Sacharov reported that in the government of Astrachan *Pegomyia hyoscyami* has two generations and winters in the pupal stage. In reply to S. Mokrzecki, the author said that, according to his observations, a solution of barium chloride can only penetrate the living tissue of leaves through wounds in their surface.

Emelianov (I. V.). **Мѣстныя опытныя станціи по прикладной энтомологіи въ Соединенныхъ Штатахъ и Канадѣ.** [The local stations of Applied Entomology in United States and Canada.] pp. 61–68. [See this *Review*, Ser. A, iii, p. 9.]

During the discussion of the papers by Pospielov [see this *Review*, Ser. A, iii, p. 239] and Emelianov, it was pointed out that in the countries visited by the authors, the population is more prepared for the task of making use of the information issuing from Entomological Institutions and takes up a different attitude towards the work of the latter. The author attributed this to the different economic, educational and agricultural conditions prevailing in those countries.

Znamensky (A. V.). **Къ вопросу о вліяніи температуры на развитіе лугового мотылька.** [On the question of the effect of temperature on the development of *Phlyctaenodes sticticalis*, L.] pp. 69–77.

Experiments are described on the development of pupae of *Phlyctaenodes* (*Loxostege*) *sticticalis*, L., the object of which was to observe the effect of various temperatures on the fertility or sterility of the females. It has been frequently noted of late years, that the females of *P. sticticalis* are often sterile, and according to Professor V. P. Pospielov this arises through their emerging from the pupae in a state of sexual immaturity, which he regards as a more or less normal condition, at least in the case of the females of the second generation, and attributes it to the influence of high temperature and dryness. This interferes with the normal development of the ovaries during the pupal stage, while the continued effect of the same causes after the insects have hatched, renders the females permanently sterile.

Attempts were therefore made to ascertain to what degree the pre-imaginal development of the ovaries depends on the temperature to which the pupae are subjected, and how far this affects the further development of the eggs. Six lots of mature caterpillars were put into six chambers of a polythermostat, the temperature in the different chambers varying from 8° to 35° C., being kept constant during the whole period of the experiment. Although all the caterpillars were in the same state of readiness to pupate, in a temperature of 35° C., they pupated in two or three hours; in 26° C., in five days; 19° C., seven days; 16° C., 14 days; 12° C., 18 days; and 8° C., 28 days. The emergence of the imago varied from 17 days in the first chamber to 29 in the fourth; no emergence took place in the remaining two chambers (with the temperatures of 12° and 8° C.), the caterpillars having built cocoons, but not pupating. The optimum temperature seems to lie somewhere between 26° and 35° C. Part of the emerged insects of each lot were immediately dissected, the remainder being kept in the insectarium; one lot of these was fed on sugar syrup, the other receiving no food whatever. The dissection of the females hatched in the first chamber (35° C) showed that the whole of the abdomen, and even the first segments of the thorax, was filled with the fat-body in which the eggs were quite buried. The females of the second lot (26°) also showed a greatly developed fat-body and

not quite developed ovaries. The females of both these lots kept in the insectarium, reached sexual maturity in 5–6 days and proceeded to oviposit, the eggs producing caterpillars in five days. These females were periodically dissected, and it appeared that during the process of oviposition the fat-body gradually diminished, and in some cases completely disappeared before all the eggs were deposited. Both the fed and unfed females showed the same further development of the ovaries and oviposited, the only difference being that the fed insects lived somewhat longer after the oviposition than the unfed. A rise in the temperature from 26° to 35° therefore leads to a progressive development of the fat-body and a more or less proportional development of the ovaries. The difference does not, however, materially affect the further maturing of the ovaries, the other conditions being equal.

The dissected females of the third (19°) and fourth (16°) lots showed a slightly developed fat-body and ovaries even less developed than in the first two lots. Those which were kept in the insectarium did not oviposit, either when fed or unfed. The temperature of 19° and lower is evidently unsuitable for the development of the pupae, and at 16° only five imagines hatched.

In nature, females are often found with a strongly developed fat-body and undeveloped ovaries, but these, contrary to the results obtained in the laboratory, remain sterile. This was the case during the summer of 1913, when all the females of the second generation were sterile, although having well-marked fat-bodies. The reason for this is uncertain, but it cannot be attributed to excessive heat over 36°, which according to experiments of V. P. Pospielov leads also to sterility, as the weather during the summer was cool and rainy.

Cold weather, bordering on the temperature at which the caterpillars pass into a state of diapuse, interferes with the development of the ovaries and leads to the fat being consumed for other processes; the females hatch out with undeveloped ovaries and not having a supply of fat the eggs cannot mature and no feeding can restore the sexual maturity to such females. In nature such specimens seldom appear, as under such conditions the caterpillars pass into a state of diapuse and do not pupate, awaiting more favourable conditions.

During the discussion, V. Averin drew attention to the importance of also taking into consideration the influence of moisture on the development and fertility of *P. sticticalis*. He stated that his experiments have shown that a great degree of moisture prevents the development of the oviducts of that insect. Replying to A. Silantiev, who suggested that possibly the fertility of the females, which were fed, was due to the presence of some micro-organisms, the author denied the possibility of this, as the females from the 2nd and 3rd chambers also oviposited, and preparations of the oviducts and of the fat-body of the fertile females did not correspond with the description given by Krassilstchick of infested tissues.

Korolkov (D. M.). **Условія примѣненія мѣръ борьбы съ садовыми вредителями въ крестьянскихъ хозяйствахъ садоваго раіона Московской губерніи.** [The conditions for the application of methods of controlling orchard pests in the peasant-husbandries of the orchard region of the govt. of Moscow.] pp. 78–83.

Investigations as to how far various remedies against orchard

pests are applicable and profitable among peasant cultivators in the government of Moscow, are described. The work was conducted in a peasant orchard, containing apple and pear trees and bush fruit. The cost of the materials for remedies necessary to control such pests of apple trees as *Anthonomus pomorum* and *Psylla mali* amounted to about $6\frac{1}{2}d$. a tree, the figure rising to $7\frac{1}{2}d$. if the cost of controlling *Cydia pomonella* is added. Considering that the average yearly profit of an apple tree amounts to about 2*s*., and adding to the above the value of the work, time etc., a net profit of about 5*d*. per tree should remain. Although small, this profit may still induce the peasants to apply various remedies. With regard to the control of *Byturus tomentosus*, F., by means of removing infested raspberries and the destruction of the larvae issuing from them, it is pointed out, that for the success of this simple remedy, it is essential that the peasants should have confidence both in the cause of the injury, as explained to them by the Entomologists, and in the remedies recommended, which is frequently not the case. The present degree of profitableness of local peasant orchards does not allow of an individual campaign against pests ; successful results will only be attained if applied by all the owners in a given locality. It is hardly possible to make the application of remedies compulsory in the present state of the economic, social and intellectual development of the peasants, but the influence of the elementary schools and of the local agricultural bodies, must be utilised to educate them in the importance of this point. The author replying to various questions, stated that it is necessary to spray at least twice against *Psylla mali*, and that he had found larvae of *Byturus tomentosus* only in the fruits of raspberry and dewberry.

KURDJUMOV (N. V.). **Къ вопросу о направленіи работъ энтомологическихъ станцій.** [On the question of the direction of the work of Entomological Stations.] pp. 84–93.

The author contends that at present Economic Entomologists are apt to devote themselves too exclusively to the study of the biology of various insect pests, and advocates the necessity of paying more attention to researches on the plants affected. He considers that the best methods of controlling insects must be based on an accurate knowledge of the nature of the injuries to the plants, of the way in which the plants react to these injuries generally, and particularly under various conditions of cultivation, etc. The importance of zoological research in Applied Entomology is not denied, and this must be brought to an even higher level, but at the same time it is of the first importance that the plant itself should be studied from an entomological point of view.

In the course of his own work in the Entomological Branch of the Poltava Agricultural Experiment Station, one of the first questions with which the author had to deal was the determination of the influence of various methods of cultivation upon the degree of infestation of grain by various pests. In order to formulate the comparative results it was necessary to devise some method of arriving at a reliable index of infestation. Here a serious difficulty at once arose, for it was found that different samples from the same area yielded widely different

percentages of injured plants. In the case of the wheat sawfly (*Cephus ? pygmaeus*) it was found that samples containing 200–300 stems gave quite unreliable results, and that the probable error is fairly high even in samples containing 1,000 stems ; so that in order to obtain an approximately reliable standard, still larger samples must be taken. The attempt to arrive at an index of infestation in the case of *Oscinella frit* was still less satisfactory, for the inequality of the samples was even more pronounced. Even when each sample comprised 1,000 plants, it was found that the percentage of infestation in one sample might be nearly double that in another.

A further point which had to be considered was the method of taking the samples. At first, the stems or plants were selected at random throughout the field, but this was abandoned as unsatisfactory. Then limited areas of $5\frac{1}{2}$ square feet were investigated in detail ; but this system also proved unreliable, principally owing to the uneven distribution of the pests. The method finally adopted was to select a stem or plant at every alternate pace up and down the plot ; but the author is by no means satisfied that even this will give sufficiently consistent results.

Another question, which naturally arose during the work, was that of studying the influence of the injury on the plant. This is dealt with in a paper by Andreieva and the author (see above p. 230). The loss due to insects can be determined in two ways :—Statistically, by examining a sufficient number of plants, both injured and uninjured, taken from the field ; and experimentally, by placing the plants in quite similar conditions and then infesting them artificially. Up to the present the statistical method only has been used. The author's observations have shown that the majority of insects prefer for oviposition strong plants, rather than weak ones ; so that if the effect of insect injury is tested merely by comparing the weights of attacked and immune plants, the apparently absurd conclusion may be arrived at, that the average weight of the infested plants is higher than that of healthy ones, and that the infestation by an insect thus apparently increases the harvest. In so far as such pests as the wheat sawfly are concerned, it is not difficult to correct the error, by selecting for comparison plants which are approximately of the same size ; for the sawfly does not attack the wheat until the plants have already attained their full growth. In such circumstances it is quite possible to determine the loss by the statistical method.

In the case of *Oscinella frit* the matter is different. It was not found possible to select plants from the fields between which a reliable comparison could be made. The whole subject will have to be examined under definite artificial conditions.

It is not only very desirable, but very necessary, to investigate more closely the injury itself from an anatomical and physiological point of view, as at present little or nothing is really known. The chief outcome of such work will be the determination, within the limits of such accurate experiments as may be possible, of the influence of agricultural methods on the infestation of the plants by insects. The questions themselves and the methods of investigation are sufficiently diverse and every worker will perforce become an innovator.

During the discussion, A. Sopotzko suggested that when studying the influence of pests on plants, it is necessary to take into consideration

all factors which may affect the insect in one way or another, such as economic, meteorological and other conditions, while Prof. Pospielov defended the zoological method of research, as the results obtained by that method are also important in agriculture. In summarising the discussions the chairman, Prof. N. Kulagin, reduced them to the following:—The objects of agricultural entomology consist of (1) the study of insect pests from every point of view, (2) the study of the changes in plants caused by insects, and (3) the study of the concomitant meteorological and agricultural conditions.

KURDJUMOV (N. V.). **Особенности развитія** *Collyria calcitrator*, **Grav.** [The peculiarities of development of *Collyria calcitrator*, Grav.] pp. 94–96.

The Ichneumon, *Collyria calcitrator*, Grav., is one of the principal parasites of the wheat sawfly, *Cephus pygmaeus*, frequently destroying 75 per cent. of its larvae. The adult parasites hatch in spring from the wintering cocoons of the host remaining in the fields in the stems of cultivated grain plants. Although it was known that *C. calcitrator* is an internal parasite of the sawfly, it has not been discovered in which stage of the host infestation is effected, but it has been stated that the parasite oviposits in the young larvae. The author observed once in 1907 and again several times in 1912, that the females of the parasite pierce with their ovipositor the stems of wheat at points where there was always found an egg of the host, and larvae were never discovered in such stems. In 1913, experiments were undertaken at the Station of Poltava which have satisfied the author that it is the egg of the host which is infested by the parasite; the egg of the latter develops very slowly and produces a larva inside the body of the larva of the host, where it winters, destroying its host in the next spring. Mention is made of ENCYRTIDAE (CHALCIDOIDEA) and PLATYGASTERIDAE (PROCTOTRYPODEA) which infest the eggs of their hosts in the same way, the larva developing inside the host larva, and *Chelonus texanus*, Cress. (BRACONIDAE) and *Tetrastichus asparagi*, Crawfd., (CHALCIDOIDEA) are stated to have the same habits. *Collyria calcitrator*, Grav., is the first representative of the ICHNEUMONIDAE, which has been proved to have a similar life-history.

MAMONTOV (I. I.). **О безплатномъ пропускѣ средствъ для борьбы съ вредными насѣкомыми.** [On the duty-free import of means of fighting insect pests.] pp. 97–100.

The author, who represented the Central Board of Land Administration and Agriculture at the Conference, after giving an account of the present procedure of allowing duty-free importation of insecticides, of which in 1911, 450 cwt., and in 1912, over 960 cwt., were imported in this way, suggests some reforms in order (1) to concentrate the administration of this question under the authority of the Department of Agriculture; (2) to form a special Bureau to deal with the disbution, etc., of imported insecticides; (3) to forbid the import or use of

insecticides the composition of which is kept secret by their manufacturers; (4) to create a Central Experimental Chemical Laboratory for analysing various remedies appearing on the market; and (5) to create premiums for the local manufacture of various insecticides. The Conference adopted all the suggestions except the last, and also expressed the opinion that such goods should be transported by the railways, etc., at privilege rates.

Mokrzecki (S. A.). **Результаты двадцатилѣтней дѣятельности Энтомологической Организацiи Таврическаго Земства въ Симферополѣ.** [Results of twenty years work of the Entomological organisation of the Taurida Zemstvo in Simferopol.] pp. 101–106.

The Entomological Organisation of the Zemstvo of Taurida was established in 1893 after a large outbreak of *Eurygaster maurus*, which in the previous year had resulted in the loss of 62,000 acres of winter-sown wheat, and the author was appointed to the post of Entomologist of the Zemstvo. When he started his investigations of the damage done by this Pentatomid bug, he was accompanied by a Greek Orthodox pope and a Tartar mullah. He describes the difficulties experienced during the first years of his work owing to the absence of a properly fitted station, and to the backward state of Applied Entomology in Russia at that time. There was nobody from whom to learn in Russia and he had, in consequence, to begin by studying the work of American authors. The introduction of various methods of fighting pests, both by means of insecticides, etc., and by applying progressive methods of cultivation, was rendered difficult owing to the ignorance and prejudice of the public. The farmers have only gradually become converted to new ideas, and have now themselves asked that the control of certain pests should be made compulsory. This was later effected in respect of the destruction of winter nests of *Aporia crataegi* and *Euproctis chrysorrhoea*. The author has also been instrumental in bringing about the establishment of posts of local instructors and of the Natural History Museum of the Zemstvo in Simferopol, which had at its disposal only two rooms in 1895, but now occupies eleven rooms, containing a rich collection of the fauna, flora and geology of the Crimea. The author made the following suggestions, which were all adopted by the Congress:—(1) Only the scientific work of Entomologists, under conditions prevailing in nature, can form a basis for the introduction of applied remedies; (2) the Directors of Entomological Stations must be freed from all duties connected with travelling, lectures, instruction, etc.; (3) they must possess a higher (University) education and have worked for some time in Entomological Stations or at Agricultural High Schools; (4) the first place amongst the objects of the Stations must be occupied by researches into the biology of insect pests in connection with local agricultural requirements; (5) the Department of Agriculture should be asked to increase the stipends of students sent for purposes of practical work to various stations, so as to create a body of workers in applied entomology.

Pospielov (V. P.). **О дѣятельности опытно-энтомологическихъ станцій въ Италіи и Германіи.** [On the work of the Entomological Research Stations in Italy and Germany.] pp. 107–117.

The author visited in 1912, on behalf of the Russian Department of Agriculture, some of the Entomological Stations in Italy and Germany, and this paper contains the results of his observations. He describes the organisation and the work of the Entomological Station in Florence, the laboratory of the School at Portici, and refers also to some other entomological organisations in Italy. In Germany, the work of the so-called "Pflanzenschutzstationen" is mostly concentrated on the study of fungus diseases and to a less degree on that of insect pests. Only of late years has entomological research work been started at various Stations and Institutions, of which the author describes more or less fully the Baden Experimental Station, the Biological Institute in Dahlem, near Berlin, and the Institute of the Emperor William in Bromberg. He refers to the work of Professor Rörig on the agricultural importance of birds, and points out that the stations at Florence and at Bromberg are of the same type as the Entomological Bureaus in Russia, and are not able to devote themselves to any great extent to purely scientific research, but are more closely concerned with advising and assisting the agricultural population in controlling insect pests.

Sacharov (N. L.). **Борьба съ саранчей въ Астраханской губерніи въ 1913 году и желательная организація ея въ будущемъ.** [The campaign against locusts in the govt. of Astrachan in 1913 and desirable organisation in future.] pp. 118–122.

Various species of locusts appear as permanent pests of field crops in the northern part of the government of Astrachan and of the natural meadows in its southern part, the species found in the former area being *Caliptamus* (*Caloptenus*) *italicus*, *Oedalus* (*Pachytylus*) *nigrofasciatus*, De Geer, and *Oedipoda coerulescens*, L., while the common pest in the latter is *Locusta* (*Pachytylus*) *migratoria*, L. The last-named is found exclusively in the reeds of the delta of the Volga, the chief foci being situated in the "Baer ridges" on the islands in the Volga, which are not flooded; these ridges usually have no plants at all or are covered with plants characteristic of saline areas, but they are surrounded with meadow plants and reeds on which the insects find plenty of food. The breeding places of the species of the northern part of the government are situated in the steppes of the Zarev district. Up to 1912, the control of locusts was conducted by means of driving the larvae into trenches or burning them, and only in that year was the chemical method introduced. In 1913, some 13,500 acres were infested with *L. migratoria* and 2,700 with the other species, and £2,100 was assigned for the campaign against them. Notwithstanding various difficulties inherent in the nature of the country, such as floods, inaccessible spots, heavy dews and mosquitos (*Anopheles* and *Culex*), the campaign in 1913, conducted exclusively by chemical methods, led to a total destruction of the pests in those places where it was applied. The concentration of the organisation of the campaign in the hands of some one institution of the government is urged. It

should also be made compulsory, as far as the natural conditions allow, only to employ paid labour and to create a special locust fund by means of a special land tax for that purpose. [See this *Review*, Ser. A, ii, p. 53.]

Silantiev (A. A.). **Прикладная зоологія, какъ предметъ преподаванія въ сельско-хозяйственныхъ учебныхъ заведеніяхъ и постановка этого предмета на СПБ. Сельско-Хозяйственныхъ Курсахъ.** [Applied Zoology as a subject of teaching in the agricultural school and its position in the St. Petersburg (Petrograd) Agricultural Classes.] pp. 123–130.

Reference is made to the great and ever increasing demand of late years for expert advisers in agriculture in Russia caused by the urgent necessity of improving the methods of cultivation in that country, as well as of perfecting the teaching of applied zoology generally, and applied entomology in particular, in the middle and higher agricultural and professional schools. The author advocates a system of teaching which would give the student the necessary amount of systematic knowledge and acquaint him with the biology of the principal pests, as well as with the present methods of controlling them. As an illustration of his ideas on this subject, the author describes the method of teaching adopted by him at the agricultural classes in Petrograd, where the students, after having heard during the first winter a course on theoretical zoology, study during the summer term, by means of excursions, lectures and laboratory work, practical methods of collecting, preserving and making biological observations on insects and other animals. During the second autumn and winter terms, the lectures on zoology go hand in hand with practical work in the laboratory, followed in the second summer term by field investigations into the local fauna and the biology of pests.

Of the several proposals put forward, the Congress adopted the following: (1) Owing to the differences in the methods of teaching theoretical and applied zoology, special readerships in both these subjects ought to be created in the higher agricultural and forestry schools; (2) the teaching of applied entomology ought to be supplemented by lectures on special subjects, to be given by experts invited for this purpose; (3) that the time has arrived for the establishment of a special Institute of Applied Zoology.

Troitzky (N. N.). **Жизнь и дѣятельность вишневаго слоника въ Туркестанскомъ краѣ по наблюденіямъ 1912 и 1913 гг.** [The life-history of *Rhynchites auratus*, Scop., in Turkestan, according to observations in 1912 and 1913.] pp. 131–134.

A short account is given of the life-history of *Rhynchites auratus*, Scop., in Turkestan [see this *Review*, Series A, i, p. 438]. The weevils appear at the beginning of April and attack first the blossoms of cherry trees, gnawing a hole in the side of the calyx and frequently penetrating into and destroying the ovary. In 1913, 63–66 per cent. of the blossoms were damaged in this way. Later, when the young fruits appear, the beetles feed exclusively on them and the amount of fruit

damaged at that stage in 1913 reached 74 per cent. The females, which lay their eggs in the fruits, also do a great deal of damage. A Chalcid parasite of the eggs of *R. auratus* was observed [see this *Review*, Series A, i, pp. 436–437], from 50 to 72 per cent. of the eggs being infested.

TROITZKY (N. N.), **Нѣкоторыя данныя о дѣятельности яйцеѣдовъ плодожорки въ Туркестанѣ.** [Some data on the activities of parasites of eggs of the codling moth in Turkestan.] pp. 135–139.

A short account is given of the history of the endeavours to import *Trichogramma* (*Pentarthron*) *carpocapsae*, Ashm., into Turkestan. I. V. Vassiliev was not able to find, in 1909 and 1910, any parasites of *Cydia pomonella* in that country, while Radetzky discovered in 1911 only two species (*Ascogaster canifrons*, Wesm. and *Pimpla* sp.) which between them infested less than 2 per cent. of the caterpillars [see this *Review*, Series A, i, pp. 367–370]. An examination, in 1913, of various orchards in Turkestan, including those in which artificially bred specimens of *T. carpocapsae* had been liberated, led to the discovery of other parasites of the eggs of *C. pomonella*. Amongst these N. Kurdjumov has identified the following: *Trichogramma embryophagus*, Hrtg., in Tashkent, *T. semblidis ?*, Aur., (*minutum ?*, Riley) in Tashkent, and *Trichogramma* sp. in Ferghana and Samarkand, where *T. carpocapsae* was absent.

UVAROV (B. P.). **Современное положеніе саранчеваго вопроса на Сѣверномъ Кавказѣ и мѣры къ его разрѣшенію, въ связи съ общей организаціей борьбы съ саранчевыми.** [The present position of the locust question in North Caucasia and methods of solving it, in connection with the general organisation of the campaign against locusts.] pp. 140–149.

Of the various species of locusts found in North Caucasia, *Dociostaurus* (*Stauronotus*) *marocanus*, Thunb., and *Locusta* (*Pachytylus*) *migratoria*, L., are of the greatest economic importance. *L. danica*, Charp., is frequently found with the latter, but is unimportant. The breeding places of *S. marocanus* in North Caucasia are situated in the dry sandy steppes, known as Nogai and Kasanogai, adjoining each other in the north-western part of the province of Terek and south-eastern part of the government of Stavropol. The locusts show a tendency to spread in a western and north-western direction into the government of Stavropol. The hatching areas of *L. migratoria* have not yet been sufficiently investigated, except those situated in the latter government. A short historical account is given of locust outbreaks and the campaign against them during recent years, with special reference to the government of Stavropol, and the successful results of the chemical method are emphasised. It is stated that the present methods of fighting locusts guarantee complete success, the partly unsuccessful results of previous campaigns having been due to local and not to general causes, such as the neglect of locust work in the neighbouring governments and the absence of special funds. The solution

of the locust question in North Caucasia must be based on co-operation between the individual anti-locust organisations by means of yearly conferences, etc., the revision of and radical changes in the law applying to the campaign, and the creation of special funds in each of the affected governments.

The Locust Section of the Congress, after a discussion on the papers by Sacharov, Uvarov (see above) and Schreiner (see below) adopted the following resolutions :—(1) The chemical method is at the present time the most successful and efficient, all other methods being admissible only under special local conditions; (2) the control of locusts must be made compulsory for all the affected localities and all groups of the population. The suggestions of B. Uvarov as to special funds and co-operation between anti-locust organisations, as well as the necessary changes in the law, were approved. These resolutions were confirmed by the Congress.

Fabrikant (A. O.). **Объ учрежденіи Донского Энтомологическаго Бюро.** [On the creation of the Don Entomological Bureau], pp. 150–157.

The necessity of creating a special Entomological Bureau for the province of the Don is suggested and the urgency of the matter is illustrated by a few instances of the enormous damage done in that province by various insect pests; large areas infested with egg-clusters of locusts, especially of *Caliptamus* (*Caloptenus*) *italicus* were noticed in some parts of the government; *Eurygaster integriceps*, Osh., has infested some 135,000 acres of forest; over a million acres of field crops, including at least 234,000 acres of summer-sown wheat of a value of half a million sterling, are threatened by various insect pests; outbreaks of *Epicometis hirta*, Poda, and of *Phlyctaenodes sticticalis*, L., have also occurred in the province.

Schreiner (J. F.). **О необходмости реорганизацій дѣла борьбы съ марокксной кобылкой въ Бакинской и Елисаветопольской губерніяхъ.** [On the necessity of reorganising the method of fighting *Dociostaurus maroccanus* in the govts. of Baku and Elisavetpol.] pp. 158–177.

A large number of injurious Orthoptera occur in the Transcaucasian steppes, the most important being *Dociostaurus* (*Stauronotus*) *maroccanus*, Thunb., *Locusta* (*Pachytylus*) *danica*, L., *Caliptamus* (*Caloptenus*) *italicus*, L., and *Oedaleus nigrofasciatus*, De Geer, their multiplication being controlled only by various parasites. Of late years, large outbreaks of *D. maroccanus* have constantly occurred, while an increase in the numbers of *L. danica* has also been observed.

It is thought that *D. maroccanus* originally bred on the wild plants in the steppes of Transcaucasia, having arrived there from Persia, but lately it has become a local species, concentrating in the steppes near cultivated fields and annually causing enormous damage. The best contributory means towards the destruction of this pest, both in Transcaucasia and in the neighbouring Persian Moghan steppe, would be the intensive colonisation of the country, which tends to transform

the steppes into cultivated land, on which locusts do not breed. Owing to the beginning of field cultivation in the Persian Moghan steppes in 1912, the migration of the insects in 1913 into Russian territory was much smaller and occurred considerably later. It is thought that the reduction of the steppe areas and the increase in the area of cultivated land make it unnecessary for the pests to undertake large migrations, as they find sufficient food on the spot.

The author describes his observations in the governments of Baku and Elisavetpol, where he was sent in 1913 by the Department of Agriculture in order to demonstrate the chemical method and to investigate and report on the necessary organisation of the campaign in future. The usual method of control consisted in driving the locusts into trenches, etc., and their destruction by various mechanical means. Experiments and demonstrations on the spot with spraying apparatus were most successful, the best insecticides being:—(1) 5 lb. of sodium arsenite in powder and 20 lb. of potato molasses dissolved in 135 gallons of water; and (2) 5 lb. of Paris green (mark 707), 8 lb. of sal-ammoniac and 40 lb. of molasses in 135 gallons of water. The first of these insecticides is somewhat cheaper, one charge costing 4s. 3d. as compared with 5s. 4d. in the second case. The day after the spraying, 90 per cent. of the hoppers were dead and in a few days there were no living ones left, even those arriving later being poisoned. Although there are many places in Transcaucasia not covered with plants, the author is of opinion that that fact cannot serve as a reason against the chemical remedy; the insects always oviposit on steppes, where the upper layers of the soil is full of small roots of various plants and grasses which, at the moment when the larvae hatch out in spring, provide sufficient food for their development. The larvae of *D. maroccanus* are largely polyphagous, feeding on all kinds of steppe plants. Various soapy and other such insecticides, which have an external effect on the larvae as contact poisons, are not recommended, as they are expensive and uncertain in their effects, and the spraying with them requires hand apparatus with high pressure and a strong spray. The campaign against the larvae of *D. maroccanus* was conducted in various parts of the country mostly by means of trenches (some of them having wells in their bottoms and others being filled with water), by iron shields, and by burning. Good results were obtained by applying the shields in combination with burning. The trenches filled with water proved less effective than ones in which the larvae were automatically killed, those below being crushed by the weight of those above, the trenches being covered with earth when quite full. The hatching of the larvae from the eggs took place in the first half of April, and continued for seven or eight days; the development of the first stage hoppers lasted about eight days, of the second, about seven; third and fourth about eight each; the fifth about ten. Winged forms appeared between the 16th and 26th May. Oviposition was finished by the local individuals in the first half of June, while the insects which arrived from Persia oviposited until 29th June. The insects disappeared finally on 3rd July; the whole cycle from egg to imago thus lasting, in 1913, 41 days. The fourth and fifth larval stages and the imago are the most injurious. Amongst the natural enemies of *D. maroccanus* in Transcaucasia are rooks, crows, jackdaws, starlings, a lizard (*Ophisaurus* sp.), *Mylabris* 4-*punctata*, *M. floralis*,

M. 10-punctata, *M. 12-punctata*, *M. beckeri*, etc., some species of BOMBYLIIDAE, and a species of *Trombidium* (probably *T. parasiticum*, Herm.), which lives both on the larvae of the 4th and 5th stage and on the imago. It is recommended that the campaign against *D. maroccanus* in Transcaucasia should be conducted by means of (1) chemical remedies, and (2) burning in combination with iron shields ; the second remedy may be applied everywhere in waterless steppes and serves as a useful addition to the chemical method ; this avoids the use of trenches, the digging of which necessitates a sort of compulsory service on the part of the natives.

UVAROV (B. P.). **Организація и дѣятельность Ставрополскаго Энтомологическаго Бюро.** [The organisation and work of the Stavropol Entomological Bureau.] pp. 178–183.

The Stavropol Entomological Bureau was established in 1912, after large outbreaks of locusts since 1909, and its budget consisted in 1912 of £675 and in 1913 of £985, of which £910 was assigned by the Department of Agriculture and the remainder was raised from local funds. The chief work of the station consisted in supervising the campaign against locusts, so that both the scientific work of the Bureau and the work of controlling various other pests has been left more or less in abeyance. The necessity for further researches, owing to the local biology of insect pests being unstudied and in many respects different from that in other governments, is urged, and the establishment is suggested of an Entomological branch at the existing Experimental Station of the Municipality of Stavropol.

I. Besides the above 22 papers, others were read by :—

(1) A. A. Sopotzko on " The organisation and work of the Entomological Station in Tula." Replying to the debate, the author stated that the work of the Station extended over the government of Tula and, since 1912, over those of Kaluga and Orel, where there are only Entomological Bureaus, and that the work of instruction interferes greatly with that of investigation.

(2) V. I. Plotnikov advocated the establishment of an Entomological Inquiry Bureau at the Russian Entomological Society, which should assist in the identification of insects, supply books and journals on various aspects of Entomology, and reply to inquiries relating to the work of local Entomologists. During the discussion, I. I. Mamontov informed the Congress that it is proposed to reform the existing Scientific Committee of the Central Board of Land Administration and Agriculture into an Institute of Experimental Agriculture, when it will be possible to allocate the functions advocated by the author, to the existing Bureau of Entomology of the above Committee.

II. The Section of the Congress on the Entomological supervision of grain cargoes transported by rail adopted a resolution, in which the study of the biology and ecology of pests of grain stores is urged, with special reference to the conditions under which a given grain cargo may be considered infested. The resolution calls the attention of the

Ministry of Communications to the necessity for more rational buildings for elevators and grain stores and for a thorough cleansing and disinfection of the same between the removal of one cargo and introduction of another, and also confirms the resolutions of a special conference of railway officials and entomologists in 1912 in Moscow, with regard to *Calandra granaria*, prohibiting the acceptance for transport of grain infested with that pest, and dealing with the method of isolation of grain cargoes discovered during transport to be infested with this weevil. The Congress referred this resolution for consideration at the next Congress, where this question ought to be re-opened and thoroughly discussed, and adopted a resolution proposed by V. Plotnikov urging the necessity of special disinfecting stores at the Custom houses for cotton seed imported into Russia from abroad.

III. On the question of the direction of, and co-operation between, the work of entomological organisations, the Congress adopted a resolution, which recommends (1) the establishment of a "Russian Society of Economic Entomologists," the articles of association of which are to be discussed at the next Congress; (2) the establishment of some central authority to which the separate Entomological Organisations should present yearly reports on the local insect pests and the damage caused by them; and (3) the foundation of a journal of Applied Entomology.

LIND (J.), ROSTRUP (S.) & KOLPIN-RAVN (F.). **Oversikt over Landbrugsplanternes sygdomme i 1913.** [Summary of the diseases of agricultural plants in 1913.]—*79 Beretning fra Statens Forsögsvirksamded i Plantekultur, Copenhagen*, no. 30, 1914.

This paper consists of a review of damage caused during 1913 by insects and fungi in Denmark. Cereals were attacked by the larvae of *Tipula paludosa*, which caused severe injury at Thisted, where as early as the end of May, about five acres of oats were destroyed. The larvae of *Phyllopertha horticola*, at the beginning of October, destroyed the rye at Kibaek. *Heterodera schachtii* var. *avenae* was, as usual, very common in the oat fields all over the country. The attacks of these nematodes were first observed at the end of May, and in many localities over 50 per cent. of the fields investigated were found to be infested. In most cases, the cultivation of oats several times in rotation was held to be responsible. The first puparia of *Hylemyia coarctata* were found on the 9th May. The infested area, which previously had been chiefly in Lolland-Falster and the South of Fyn, has during the last ten years moved northwards. The severity of the attack in 1913 is attributed to the mild winter, which favoured the early development of the fly. *Oscinella* (*Oscinis*) *frit* has been abundant in many localities and caused serious injury, but less so than in 1912. Late-sown oats were chiefly attacked. As in 1912, *Chlorops taeniopus* was very scarce. Attacks on rye by the caterpillars of *Trachea* (*Hadena*) *secalis* have as usual been recorded in May and June, and in one locality, as early at the end of April. At Aarhus, the severity of infestation has diminished successively during the last few years

without any visible cause. *Hydroecia micacea*, at the beginning of June, damaged rye at Malling. *Contarinia* (*Cecidomyia*) *tritici* and *Sitodiplosis mosellana* (*Cecidomyia aurantiaca*) did not do so much harm as in 1912. An attack of *Mayetiola* (*Cecidomyia*) *destructor* was recorded at Staevne at the beginning of July. Damage caused by Thysanoptera has been rather common, especially to rye. At Aarhus, rye and wheat suffered somewhat from the Pentatomid, *Eurydema* (*Strachia*) *oleracea*, which in that locality seems to develop on *Verbascum thapsus*. *Siphonophora cerealis* and *Aphis avenae* appeared at the end of June on oats and barley. *Tarsonemus spirifex* is recorded from several localities, including Askow Experiment Station, where, however, oats in well manured areas nearly escaped. In northern Sleswick, as usual, the so-called Schlanstedt oats were seriously damaged, while other varieties suffered less. As regards the question of rotation, it has been observed that mixed crops nearly always cause the mite to appear in oats following them. For this reason, and owing to the presence of *Heterodera schachtii* var. *avenae*, endeavours are being made to abolish the growing of mixed crops in these places.

Leguminous plants were attacked by the weevil, *Sitones lineatus*, which was exceedingly common, especially at the end of April and beginning of May, and in many places seriously injured vetches and peas. At Thisted, the attack, which was very pronounced in May, stopped owing to the rain. *Aphis rumicis* (*papaveris*) at the end of June made its appearance on horse-beans. At Lyngby, and possibly also other places, aphids were checked in August partly by a parasitic Hymenopteron, partly by the fungus *Empusa fresenii*, and had for the most part succumbed when the rain set in. The caterpillars of *Grapholitha* sp. in some localities destroyed 85 per cent. of the pods. Attacks of *Contarinia* (*Cecidomyia*) *pisi* on the pods were not common, but attacks of other gall-midges (not identified) on the flowers and shoots of leguminous plants have occurred in several localities, as well as serious damage caused by *Kakothrips* (*Physapus*) *robustus*. At the Agricultural High School, *Chortophila* (*Anthomyia*) *funesta* attacked lupins in July.

Sugar-beet and beetroot pests included the larvae of *Silpha opaca*, which are suspected of causing damage to sugar-beets in June and the beginning of July all over the country. The plants become constricted just below the surface of the ground, topple over and wither. This happens however about three weeks after the injury, which accounts for the larvae of the beetle being seldom found near the injured plants. In some localities, injury caused by the larva of the Noctuid, *Hydroecia micacea*, occurred. Serious attacks of *Heterodera schachtii* were recorded from the South of Fyn and Lolland. The beetle, *Atomaria linearis*, was only observed in one locality at Abed. *Aphis rumicis* appeared on seed beets in the end of June, but generally the attack culminated in the second half of July. It was observed that aphids were spread in some cases by the wind.

Turnips and cabbage were attacked by the maggots of *Chortophila* (*Anthomyia*) *brassicae*, which were very numerous in 1913, and from June to late in the autumn caused great losses. In the north of Sleswick, as early as the end of May, both young and full-grown larvae and also eggs were found, the latter being in great numbers, attached

to the stalks close to the ground. At Samsö, a serious attack in July destroyed one-third of the seed-cauliflowers. The severity of the attack in 1913 depended on the drought, which checked the growth of the plants. *Phyllotreta nemorum*, *P. atra* and possibly other species, appeared in May in great numbers. In most of these localities the rain occurring at the end of the month stopped the attack. The weevil, *Ceuthorhynchus sulcicollis*, was recorded in July in several places and *C. quadridens* was comparatively common. At Aarhus, *Eurydema oleracea* damaged the turnips. *Plutella maculipennis* (*cruciferarum*) was observed from the end of June to August in several localities without however causing any damage as a rule. Cauliflowers in one locality were completely destroyed by *Forficula auricularia*. *Aphis brassicae* occurred in unusually great numbers and caused great damage, especially to turnips and all kinds of cabbage. In some places it appeared as early as June, but generally there was no complaint of exceptional injury before July. *Meligethes aeneus*, *Ceuthorrhynchus assimilis* and *Perrisia* (*Cecidomyia*) *brassicae* occurred in great numbers, and in several places caused great damage. The carrot fly, *Psila rosae*, was very common and chiefly damaged early sown carrots.

Potato pests included the bugs, *Calocoris bipunctatus* and *Eurydema oleracea*, which were recorded from several places ; at Varde a weevil, *Cneorrhinus plagiatus* (*geminatus*), was observed gnawing holes in the leaves.

Clover was attacked by three weevils, *Sitones lineatus*, *Apion apricans* and *A. pisi*. *Lotus corniculatus* was damaged by *Contarinia* (*Cecidomyia*) *loti*, and in July and August by APHIDIDAE. The eelworm, *Tylenchus devastatrix*, appeared in great numbers in the spring and its attacks continued through the summer until late in the autumn.

Forage grasses were attacked by the mite, *Pediculopsis* (*Pediculoides*) *graminum*, the Scatomyzid fly, *Clidogastra* (*Cleigastra*) *flavipes* and the caterpillars of *Trachea* (*Hadena*) *secalis* and *Laperina* (*Apamea testacea*.

Against wireworms in wheat, Chile salpetre in April gave good results, but kainit, on the contrary, proved quite ineffective, even at the rate of 16 cwt. per acre. At Tystofte, the plants were protected from oviposition by species of *Agrotis* by covering them during the night with cheese-cloth. Against *Aphis rumicis* spraying the seed-turnips with tobacco emulsion was very useful.

KNAB (F.). **Drosophilidae with Parasitic Larvae.**—*Insecutor Inscitiae Menstruus, Washington, D.C.*, ii, no. 11, November 1914, pp. 165–169. [Received April 1915.]

Two new species of DROSOPHILIDAE are described : *Gitonides perspicax*, gen. et sp. n., Hawaii and Philippine Islands, which has been reared four times from *Pseudococcus* ; and *Titanochaeta ichneumon*, Hawaii, reared from larvae feeding on spider's eggs.

Shannon (R. C.). **Habits of Some Tachinidae.**—*Proc. Entom. Soc., Washington, D.C.*, xvi, no. 4, December 1914, p. 182.

Many Tachinids are stated to be of nocturnal habit, including :—*Eutrixa exile*, Coq., *Cryptomeigenia theutis*, Walker, and an apparently new species of *Neophyto*. Members of the genus *Trichopoda* have recently been bred from various Hemiptera, one from *Metapodius terminalis* and one from *M. instabilis*. *Reduviolus roseipennis* is stated to have been parasitised by *Leucostoma atra*, Towns.

Dietz (P. A.). **Het Katjang-Vlindertje (het Vermeende Toa-Toh-Motje).** [The Katjang Moth (the so-called toa-toh-moth).—*Meded. v. h. Deli Proefst., Medan*, viii, no. 8, 1914, pp. 273–278. [Received 15th January 1915.]

In consequence of the War in Europe, the tobacco planters of the East Coast of Sumatra are growing large quantities of food-stuffs for man and animals, and it is pointed out that this change of cultivation may possibly lead to the importation of new insect pests or the serious development of those which are at present regarded as of small account. The Pyralid moth, *Maruca testulalis*, is very widespread on katjang idjoe (*Phaseolus mungo*) and the author calls it the katjang moth to distinguish it from the toa-toh moth, *Phthorimaea operculella* (*Lita solanella*), with which it is often confused. The eggs are laid on the flower buds of the katjang, the caterpillar bores into the bud and consumes it from within outwards, binding the flowers and buds together with a web. Before the caterpillar is full grown, the buds and flowers fail to supply sufficient food, and it attacks the pods, bores through them and eats the seeds. It is then ready to pupate and generally falls to the ground, but cases of pupation in the pod are not uncommon ; the pupal stage in the ground lasts 9 or 10 days and the whole life-cycle from five to six weeks. Early picking is of little use, as the pods are damaged long before they are ripe. In some cases, instead of attacking the pods, the caterpillar in the later stages of its life, bores into the stem. It is this habit which has caused it to be confused with *P. operculella*, but the tobacco-growers have no cause for alarm, as it will not attack tobacco. The hole in the stem is characteristic, being large and irregular and without any local swelling, whereas *P. operculella* makes a clean round hole ; when the katjang moth attacks the stem, it pupates in the ground, which is not the case with *P. operculella*. Kedelé (*Glycine soja*) is not attacked, nor is *Canavallia ensiformis*, probably because the pod is too thick, but *Vigna catjang* [cow-pea] is attacked in much the same way as *Phaseolus mungo* and the damage done is often greater.

Busck (A.). **Descriptions of New Microlepidoptera of Forest Trees.**—*Proc. Entom. Soc., Washington, D.C.*, xvi, no. 4, December 1914, 143–149, 3 figs.

The following new species of Microlepidoptera are described as being injurious to various forest trees : *Aegeria* (*Sesia*) *brunneri* on *Pinus ponderosa* ; *Recurvaria milleri* on *P. murrayana* ; *Evetria bushnelli*, which is seriously injurious to *P. ponderosa* and other pines ; *E. virginiana* on *P. virginiana* ; *E. taxifoliella* on *Pseudotsuga taxifolia* ; *E. metallica* on *P. ponderosa* ; *E. mortana* on *P. contorta* ; *E. albicapitana* on *P. divaricata* ; *Swammerdamia castaneae* on *Castanea dentata* ; *Ectoedemia heinrichi* on *Quercus palustris*.

Busck (A.) & Böving (A.). **On *Mnemonica auricyanea*, Walsingham.**—*Proc. Entom. Soc., Washington, D.C.*, xvi, no. 4, December 1914, pp. 151–163, 8 plates.

In April, the imago of *Mnemonica auricyanea*, Wlsm., lays its eggs singly on the opening leaves of the chestnut, oak and chinquapin. In May, the larva mines the leaf and becomes mature within a week or ten days; it then falls to the ground and burrows in the soil, sometimes as deep as 1 ft. The imago emerges in April.

Busck (A.). **Life-History of *Eucosma haracana*, Kearfott.**—*Proc. Entom. Soc., Washington, D.C.* no. 4, December 1914, p. 150, 1 fig.

The larvae of *Eucosma haracana*, Kearfott, form conspicuous rolls in the leaves of the chestnut. When adult, they leave the rolls and let themselves down to the ground into which they burrow, remaining in their cocoons until late autumn. Emergence generally takes place in April.

Crawford (J. C.). **Some New Chalcidoidea.**—*Insecutor Inscitiae Menstruus, Washington, D.C.*, ii, no. 12, December 1914, pp. 180–182.

The following new Chalcidoidea are described: *Tetrastichus compsivorus*, Oklahoma, from eggs of *Compsus auricephalus*; *T. agrili*, Geneva, New York, from *Agrilus sinuatus*; *Eupelminus swezeyi*, Hawaiian Islands, stated to be "probably parasitic on the *Isosoma* (in Johnson grass)." *Geniocerus xanthopus*, Nees, Germany, is commonly reared from the pupae of *Dendrolimus pini*; *Dirhicnus alboannulatus*, Ratz., Germany, reared from the pupae of *Panolis flammea* (*griseovariegata*).

Criddle (N.). **The Value of Some Mammals and Birds as Destroyers of Noxious Insects.**—*Ottawa Naturalist, Ottawa*, xxviii, no. 9, December 1914, pp. 119–124.

In the course of investigations on the part played by mammals and birds as insect destroyers, a skunk was observed to frequent a particular spot for the purpose of catching *Lachnosterna* (June beetles) and later to eat the larvae; the skunk also kills grasshoppers during the summer. It is estimated that 14,520 grubs were destroyed per acre, in a particular field, by two or more skunks. Flickers and crows are also important white-grub destroyers in late May, especially the former, which, accompanied by blackbirds and grackles, follow the plough, picking up the exposed grubs. The cowbird destroys the white grub, eating only the smaller grubs, and gulls are voracious feeders on all insects exposed by the plough. Crows are also great destroyers of cutworms and army-worms. The numbers of Prairie Sharp-tailed Grouse (*Pedioecetes campestris*) in the prairie provinces are stated to feed chiefly on grasshoppers. The Pennated or Square-tailed Grouse (*Tympanuchus americanus*) is said to have similar habits. Birds are of little value in suppressing severe insect outbreaks, but when pests exist in normal numbers, they do much to maintain the balance. Many of the worst pests, notably the Hessian fly, *Mayetiola destructor*, are however scarcely influenced by birds.

TULLGREN (A.). **Våra spinnmalar och deras bekämpande.** [Our ermine moths and the methods of controlling them.]—*Centralanst. för Jordbruksförsök, Medd. no. 110, Stockholm,* Entom. Avd. no. 21, 1915, 23 pp., 16 text figs.

In Sweden, seven species of ermine moths occur, only four of which do damage to cultivated plants. These are *Hyponomeuta euonymellus*, L., *H. cognatellus*, Hb., *H. padellus*, L., and *H. malinellus*, Z. The author gives the characteristics of each species, their larvae and pupae. In the larva of *H. euonymellus*, the subdorsal spots of the first eight abdominal segments are more or less divided into two and not contiguous to the hair spots. In the other species, the subdorsal spots are simple and contiguous to the hair spots, but in *H. cognatellus* the latter are larger than in the others. The author gives biological data regarding the different species, and their geographical distribution in Sweden. The only species of real economic importance is *H. malinellus*, but this insect seems to be restricted to the southern part of the country, from Skåne to Upland. The hawthorn moth (*Scythropia crataegella*, L.) has been observed repeatedly on apples during recent years. In one instance, several trees were completely covered by their webs. This species has only once been recorded previously from fruit trees, viz., on a pear tree in Germany. The observations of the author, although not complete, show that the newly hatched larvae mine in great numbers in small blotch mines in the leaves. Later they attack the leaves from the surface and spin them together. There are two generations a year, and the eggs probably hibernate.

The spray, Cooper's V2 fluid, was employed against the larvae when they had emerged and were about to enter the buds. All the larvae that were touched by the spray died, but as they did not all appear at the same time, only part of them could be killed by one application. On the 8th April, part of a hedge of bird-cherry which had during recent years been repeatedly defoliated was sprayed with lime-sulphur spray (1 part to 5 and 7 parts of water) before the buds had burst ; on the 2nd May, numerous colonies of larvae were found. Another part of the hedge was sprayed on the 15th April with 8 per cent. carbolineum emulsion ; on the 2nd May no larvae at all were to be seen, and on examination of the egg-shells a great number of dead larvae were found. On July 3rd to 4th, colonies were found in the interior of the hedge, where evidently the spraying had not been so thorough. During the whole summer, however, a striking difference could be noticed between the part of the hedge sprayed with carbolineum and the unsprayed part, the latter being completely defoliated.

As a summer spray, lead arsenate was employed (60 grams to 11 litres of water) in the beginning of June ; on the 9th June several dead larvae were found and in the course of the month all the larvae succumbed.

TULLGREN (A.). **Drivhusvaxternas fiender. 1, Skadeinsekter på chrysanthemum.** [Insect enemies of hothouse plants. 1. Enemies of Chrysanthemums.]—*Trädgärden, Stockholm,* no. 1, January 1915, pp. 9–12, 4 figs.

In Sweden, chrysanthemums in hot-houses are attacked by *Phytomyza affinis*, Fall., and *P. geniculata*, Macq., the damage being chiefly

done in January and February. The eggs are deposited by the flies in small pockets in the leaves and hatch after five or six days. The larvae mine the leaves and are full grown after three or four weeks; they pupate in the mines, the flies emerging after about 14 days. Both species also occur on wild chrysanthemum. The species preferably attacked are *C. frutescens*, *indicum* and *hybridum*, and the plants suffer greatly from the attacks and become worthless, even if they do not succumb. Not only the larvae, but also the females damage the plants, the latter making frequent use of their ovipositors in order to wound the leaves and get access to the juices. A nicotine spray called "jofurol" gave good results against the eggs and the larvae. The Capsid bugs, *Lygus campestris*, L., and *L. pabulorum*, Mey. [? *pabulinus*, L.], attack the young shoots and buds, especially of *C. indicum*, causing deformation.

Voglino (P.) & Savelli (M.). **La diffusione della *Prospaltella berlesei*, How., in Piemonte nell' anno 1914.** [The spread of *Prospaltella berlesei*, How., in Piedmont in 1914.]—*R. Osservatorio Autonomo di Fitopatologia, Turin*, 1915, 8 pp.

In order to ascertain the intensity of the parasitism of *Aulacaspis* by *Prospaltella berlesei*, inspections were made in Piedmont from mid-September 1914 up to early in January 1915. In general, good results were obtained, and in some localities the scale may be held to be destroyed. The best results are seen in cases where *Aulacaspis* infestation has not yet reached a point where the mulberry is in an advanced state of decline. By scraping the infested branches before placing *Prospaltella* on them, the task of the parasite is greatly lightened. Proper pruning at short intervals materially assists the mulberry in resisting attack. The winter cold in Piedmont is not injurious to *Prospaltella*. Satisfactory and immediate results can only be obtained if the parasite is widely spread. Expert microscopic examination of the parasitised material is necessary, as very often the scales have died from other causes or have already been abandoned by the Hymenopteron. Another active and widely distributed enemy of the scale is the Coccinellid, *Chilocorus bipustulatus*, and measures should be taken to protect it, especially its larvae, which have many enemies. Natural control by means of *Prospaltella* can only be really successful if directed by experts.

Thompson (W. R.). **Les conditions de la résistance des Insectes parasites internes dans l'organisme de leurs hôtes.** [The conditions of the resistance of internal parasitic insects in the organism of their hosts.]—*C. R. Soc. Biol., Paris*, lxxvii, (1914), no. 33, 8th January 1915, pp. 562–564.

The resistance offered by internal parasitic larvae, both dipterous and hymenopterous, to the toxic and digestive diastases, is an aspect of the adaptation of parasite to host which entomologists appear to have hitherto neglected. The author has often verified Pantel's observation that the Tachinid, *Compsilura concinnata*, Meig., remains during the larval life in the intestine of the insects which it attacks. All the Tachinids which oviposit on the food of the host are exposed

to the action of the digestive juice in the interval between hatching and penetration into the body cavity of the host. This period is usually short, but the author has noticed that the first stage larvae of *Phorocera* sp., parasitic on *Vanessa antiopa*, L., remain fixed for four or five days to the interior wall of the host's intestine by means of the numerous, strong hooks on the anterior segments. On the other hand, Marchal has studied the Proctotrupid, *Polygnotus minutus*, Lindm., the polyembryonic development of which takes place in the mid-gut of *Mayetiola* (*Cecidomyia*) *destructor*, Say. From the physiological point of view, practically nothing is known of the life conditions of the cœlom-infesting parasitic insects, but the following case is worthy of note. *Galerucella luteola*, F. Muell., is infested in some parts of Europe by the Tachinid, *Erynnia nitida*, Rond., of which Silvestri has studied the biology. Hollande has shown that the blood of this beetle contains a toxic principle which speedily kills the Carabid, *Procrustes coriaceus*, if injected into the cœlomic cavity ; subcutaneous injection will also kill a lizard. According to Hollande this toxic principle is a diastase, yet the parasite which feeds on the blood is not at all affected. The nature of this immunity of insect parasites is unknown and the question is one of considerable interest for the proper understanding of the relation between entomophagous parasites and their hosts.

KEILIN (D.) & THOMPSON (W. R.). **Sur le cycle évolutif des Pipunculides (Diptères), parasites intracoelomiques des Typhlocybes (Homoptères).** [The evolutive cycle of the Pipunculids (Diptera), intracoelomic parasites of *Typhlocyba* (Homoptera).]—*C. R. Soc. Biol., Paris*, lxxviii, no. 1, 22nd January 1915, pp. 9–12, 1 fig.

In 1854, Boheman discovered the parasitic mode of life of a Pipunculid larva parasitising cicadas, and in 1889, Giard observed species of *Typhlocyba* to be parasitised by *Ateleneura spuria*, Meig. Very little is known of these Diptera, beyond the fact that they usually oviposit in the bodies of Homoptera and may be employed in controlling some species injurious to plants, such as sugar-cane. The material used by the present authors was taken in the garden of the Luxembourg, Paris, and in the neighbourhood of Cambridge. It includes *Typhlocyba rosea*, *T. hippocastani* and *T. douglasi* attacked by *Ateleneura spuria* and what is probably another Pipunculid. A description of the parasitic larva is given. It is only when the latter has matured that it becomes possible to distinguish between a parasitised *Typhlocyba* and a healthy one.

TRÄGARDH (I.). **Bidrag till kännedommen om spinnkvalstren** (*Tetranychus*, **Duf.**). [Contributions towards the knowledge of the spinning-mites.]—*Meddelande no. 109 fran Centralanstalten för försöksväsendet pà jordbruksomradet, Stockholm*, Entom. Adveln. no. 20, 1915.

Of the five species as yet recorded from Sweden, two, *Paratetranychus pilosus*, C. and F., and *P. ununguis*, Jac., hibernate in the egg stage, the eggs being deposited in crevices on the branches of trees. In the case of *Tetranychus althaeae*, v. Hanst., and *T. telarius*, L., the females hibernate. In Sweden, spinning-mites have been recorded from the

following plants: cucumber, melon, beans, roses, vine, peach, palm and other plants in greenhouses and hotbeds, as well as on apple, plum, pear, elm, lime, maple and aspen. The greater part of the records refer to damage caused to cucumbers and melons. Spinning-mites have been found in southern and central Sweden, but north of Upsala (about 60° n. lat.) only three cases are known; knowledge of their distribution is, however, too incomplete to allow of any conclusions. As regards enemies, only nymphs of a species of *Coniopteryx* have been recorded, attacking *Paratetranychus ununguis*, Jac. This negative evidence is probably not wholly due to insufficient observations and it seems likely that the spinning-mites in Sweden have very few natural enemies. The spinning habits of the mites are very little known, which is very remarkable, as their biology in many other respects has been very thoroughly investigated. It appears that the different species vary much in this respect, some species, such as *T. telarius*, spinning plentifully, while others, like *Paratetranychus pilosus*, hardly spin at all. It is important that these questions should be investigated, as control must obviously vary in accordance with differences in this respect, the spinning forms being better protected, owing to their webs, than the other species.

Based on a comparative morphological study of the species as yet known, the author subdivides the genus into four genera. These are *Paratetranychus*; Zacher, of which the type is *P. ununguis*, Jac.; to this genus belong also *P. pilosus*, C. & F., *P. simplex*, Banks, *P. longipes*, Banks, and *P. pratensis*, Banks. *Schizotetranychus*, gen. nov. the type being *S. schizopus*, Zacher; to this also belongs *mytilaspidis*, Riley. *Neotetranychus*, gen. nov., the type being *N. rubi*, sp. n., including also *N. bicolor*, Banks, and *N. modestus*, Banks. To *Tetranychus*, Duf., belong the greater part of the known species, viz:— *T. telarius*, L., *T. althaeae*, von Hanstein, *T. ludeni*, Zacher, *T. tumidus*, Banks, *T. desertorum*, Banks, *T. weldoni*, Ewing, *T. borealis*, Ewing, and *T. flavus*, Ewing.

In Sweden, the following species are known: The fruit-tree spinning-mite, *Paratetranychus pilosus*, C. & F. The spherical, red eggs of this species are often found hibernating on apple and plum trees in such quantities that these appear quite red. The eggs hatch at the beginning of May, and during the summer at least four generations develop. Warm weather favours propagation, and damage has only been recorded when this is the case. The pine-tree spinning-mite, *Paratetranychus ununguis*, Jac., has been observed on *Picea excelsa*, *P. alba*, *P. sitchensis* and *P. engelmanni*, as well as on larch and pine; it is undoubtedly indigenous to Sweden. The eggs hibernate and there are at least four generations during a year. Severe damage has as yet only been recorded from nurseries and on hedges. *Neotetranychus rubi*, sp. n., has only been recorded once, from wild raspberries in the neighbourhood of Stockholm in the autumn. The greenhouse spinning-mite, *Tetranychus althaeae*, von Hanstein, is the most injurious species in the country, attacking especially cucumbers, melons and beans. The attacks begin in May, continuing during June, July and August unless combated. The number of generations is probably far more than four.

The common spinning-mite, *Tetranychus telarius*, L., has only been recorded from park trees, such as lime, elm, maple and bird-cherry. In Sweden, no damage caused by this species has been recorded earlier than in the end of August and the beginning of September ; in several instances the trees, especially the limes, were entirely clothed by the webs of the mites. As regards remedies, sprinkling with water in greenhouses and hot-beds in many instances held the mites in check. Spraying with quassia and nicotine emulsions gives good results, not only against the greenhouse spinning-mite, but also against the fruit-tree mite. On the other hand, lime-water as a dormant spray against the latter, proved useless.

The experiments conducted at the same time against the gooseberry mite, *Bryobia praetiosa*, K., gave the following results. Using lime-sulphur spray 1 to 5 (21° Bé.) 8·5 per cent. of the mites survived; when the strength 1 to 10 was used, 8 per cent. survived. The mites became pasted to the leaves and died ; the bushes were however too thick, which made it difficult to wet all the leaves. In order to increase the wetting power of the fluid, Vermorel and Dantony's method of adding gelatine was adopted (10–15 grams to 100 litres of water), the concentration being 1 to 20 of the spray, and quassia and nicotine were used for comparison. The number of mites, which on the unsprayed bushes was 18·6 per leaf, after the spraying diminished to 1, when lime-sulphur spray was used, to 2·6 with quassia and 2·8 with nicotine, the lime-sulphur spray thus proving the best. Against the greenhouse mite on cucumber, a still weaker solution of lime-sulphur emulsion spray was used, 1 to 40, with addition of gelatine and quassia nicotine emulsion, 40 grams per litre. The result surpassed all expectations ; the spray covered the leaves completely with a thin film and the examination on the following day revealed the fact that all of the mites were dead. An examination a fortnight later showed that all the eggs were also destroyed.

TRÄGÅRDH (I.). **Frukträdskvalstret** (*Paratetranychus pilosus*, **C. & F.**) [The fruit-tree spinning-mite].—*Sveriges Pomologiska Förenings Årgskrift, Stockholm*, **1915, pp. 29–31, 1 fig.**

The eggs of this species hibernate, often in great numbers, on the branches especially of apple and plum trees. The eggs hatch at the beginning of May and during the summer there are about four generations. The occurrence of this mite is greatly influenced by climatic conditions, attacks having been recorded only when drought and warm weather prevail. The numbers of *P. pilosus* appear to be greatest at the end of June and the beginning of July, no damage having been recorded after that time. From this it would appear that the factors controlling the mite after that date are able to exercise an effective check. As a result of the attack, the leaves turn yellow and finally drop Winter spraying with 5 per cent. carbolineum is recommended, if the eggs are detected. Later, spraying with quassia emulsion and gelatine is useful.

KEMNER (N.A.). **De ekonomiskt viktiga vedgnagande Anobierna.** [The wood-boring Anobiidae of economic importance.] *Medd. fran Centralanst. för Jordbruksförsök, no. 109, Stockholm,* Entom. Avdeln. no. 19, 1915, 43 pp., 33 figs.

The following species are of economic importance in Sweden :—*Anobium striatum*, Oliv., *Anobium pertinax*, L., *Xestobium rufovillosum*, de G., *Ernobius mollis*, L., and *Ptilinus pectinicornis*, L. After a description of their larvae and pupae, with a key to the former, the author reviews the literature and subsequently gives an account of the different species, based chiefly on his own researches.

Anobium striatum, Oliv., attacks especially pine and fir trees, but also birch, beech and alder, avoiding oak and ash on account of their harder wood. It prefers wood in houses and seldom attacks timber exposed to weather and wind. Swarming takes place in June or July. The eggs hatch in two weeks, and the tunnels are at first only 1–3 mm. wide and follow the annual rings, though in trees with more homogeneous wood, such as birch and alder, they are more irregular. When the larva is full grown, they are 1·5–2 mm. wide ; the pupal chamber is excavated close to, and parallel with the surface of the wood. After a pupal period of a fortnight, the imago appears. There is only one generation a year, individuals sometimes requiring two years to complete their cycle. *Anobium pertinax*, L., is not of the same importance as the preceding species. It attacks pine and fir, as well as the softer wood of deciduous trees. The eggs are laid singly, and the tunnels of the full-grown larvae are 3 mm. wide and often occur so closely together that larger ones are formed. The pupal chamber is generally perpendicular to the surface of the wood and measures 3·5 by 9 mm. Pupation takes place in summer, but the imago hibernates in the pupal chamber and emerges the following spring.

Xestobium rufovillosum, de G. (*tesselatum*, F.) seems to prefer oak trees and occurs both in decayed trees and in houses, chiefly attacking timber, less often, furniture. Swarming takes place in June, the eggs being laid in crevices of the wood or in the exterior part of previous tunnels. These, in the case of a full-grown larva are from 3·5 to 4 mm. wide and are generally parallel to the longitudinal axis of the tree. A generation probably requires two years, sometimes possibly three.

Ernobius mollis, L., differs from the fore-going species in that its tunnels are excavated between the wood and the bark. It ranks next to *Anobium striatum* as the most common species in Sweden. Its attacks are confined to pines and firs, and only those from which the bark has been partially removed. Swarming takes place during the whole summer, and the eggs are laid in crevices of the bark. The larva wanders about on the bark in order to find a place suitable for entering. The tunnels are at first only 0·5 mm. wide, soon widening to 3·5 mm. They are comparatively short, measuring only 6 or 7 mm. in length. The pupal chamber is 3 by 8 mm. and is situated close to the surface and parallel to it. A generation requires probably one year, but from eggs laid early in the spring a second generation apparently develops, the majority of the larvae, however, hibernating.

Ptilinus pectinicornis, L., is comparatively rare in Sweden, but occurs in houses as well as in forests.

The enemies of the ANOBIIDAE include the Clerid, *Opilo domesticus*, L., which chiefly attacks *A. striatum* and is very voracious, one specimen having been observed to devour five beetles in half an hour. The larvae enter the tunnels of the Anobiids and prey on their larvae. Pupation takes place in the spring in an *Anobium* tunnel, close to the surface of the wood, the imago emerging at the same time as the host. The importance of *Opilo domesticus* is, however, diminished by its own wood-boring habits. Another Clerid, *Corynetes coeruleus*, de G., also lives in the tunnels of *Anobium striatum* and devours its larvae. Its importance as yet is not great, on account of its limited distribution, but it is apparently spreading in the country. *Tillus elongatus*, L., is said to attack chiefly *Ptilinus pectinicornis*. Besides these beetles, a number of parasitic Hymenoptera are recorded from the ANOBIIDAE and the author has himself reared a number of them, which it is hoped will be dealt with in a subsequent paper.

After discussing the methods of prevention and of destroying Anobiid beetles, the author arrives at the following conclusions. When furniture is attacked, treatment with carbon bisulphide is the best remedy, with subsequent use of linseed oil and painting. If carbon bisulphide is not convenient, the use of paraffin, benzine or turpentine is recommended. When the attack is very serious, so that only the exterior parts are left untouched, boiling the articles in paraffin, such as is employed when cutting sections with a microtome, is very useful. Floors, walls and timbers are best treated with carbolineum or paraffin in boiling water. All these methods give the best results if employed at the time when the beetles are swarming.

MORLEY (B.). **Entomological Section.**—*Naturalist, London*, no. 696, January 1915, pp. 40–41.

Serious losses to farmers by the attacks of *Plutella maculipennis* on turnip crops, are recorded. After the young plants were thinned, the foliage became grey and the roots developed "finger and toe." Swallows were seen catching the moths. The Ichneumon, *Phygadeuon rusticellae* is reported in Leeds as parasitic on *Tineola* (*Tinea*) *biselliella*.

La campaña contra la diaspis. [The campaign against *Aulacaspis* (*Diaspis*) *pentagona*.]—*Gaceta Rural, Buenos Aires*, viii, no. 90, January 1915, p. 350.

The commission appointed by the Argentine Ministry of Agriculture has already distributed 1,500,000 twigs bearing *Aulacaspis pentagona* parasitised by *Prospaltella berlesei*, to 5,255 horticulturists.

GIRAULT (A. A.). **Some Chalcidoid Hymenoptera from North Queensland.** —*Canadian Entomologist, London, Ont.*, xlvii, no. 1, January 1915, pp. 17–20.

Included in this paper are descriptions, all made from single specimens, of the following new Chalcids :—

Lathromeroides fasciativentris and *Neobrachista novifasciata* (TRICHOGRAMMATIDAE) ; and *Polynema zolai* and *P. speciosissimum* (MYMARIDAE).

DEGRULLY (L.). **Contre la fumagine de l'olivier.** [Against the sooty fungus of the olive.] *Progrès Agric. Vitic., Montpellier,* lxiii (32nd year), 10th January 1915, pp. 42–43.

In 1906, D. Vidal gave three good formulae for freeing olive trees from sooty fungus, while killing the Coccids responsible for the presence of the mould. These are given below in order of merit, parts being understood as parts by volume. Essence of turpentine 1 part and 2 per cent. Bordeaux mixture 100 parts; soft soap 8 lb. and petroleum 25 pints, this emulsion to be mixed with 80 gals. of 2 per cent. Bordeaux mixture; strong standardised tobacco juice 1 part, and 2 per cent. Bordeaux mixture 100 parts. In compounding the first two preparations, very thorough mixing is necessary. In 1910, A. Herand recommended 3 parts of calcium sulphide in 17 parts of water. To obtain the calcium sulphide a little water is mixed with 6 lb. of fat lime and this is boiled for one hour with 4 gallons of water into which 6 lb. of sulphur has been well stirred. The best period for treatment is when the young scales emerge. Treatment must be repeated during several consecutive years. In regions exposed to sea breezes, great care and patience are necessary.

Second Biennial Crop Pest and Horticultural Report, 1913 1914.— *Oregon Agric. Expt. Sta., Corvallis,* 15th January 1915, 288 pp., 11 plates, 109 figs.

The Report of the Department of Entomology constitutes Part II (pp. 95–202) of the above report, and abstracts of the 23 papers it contains are here given in order:—

WILSON (H. F.) & MOZNETTE (G. F.). **The Fruit Tree Leaf Syneta, *Syneta albida,* Leconte**; pp. 96–101, 1 plate, 3 figs.

This Chrysomelid beetle has never been recorded out of the region of the Pacific north-west. Details of its range in Oregon are given. The injury caused by it is twofold, the larvae feeding on the fibrous roots and the adults on the flowers, foliage and fruits of fruit trees. The adults damage especially young trees and grafts, and also the fruits of apple, pear, cherry, and prune. In all cases the injury caused by the adults is seen in the spring shortly after their emergence; petals become riddled and holes are eaten in the foliage, on larger trees the former damage being the more apparent. As the petals disappear, the attack on the leaves and young fruit develops, with the result that the fruit either drops or becomes so scarred as to be unsaleable even as second-grade fruit. Hibernation occurs in earthen cells at 6 to 14 or more inches below the surface of the ground. The first pupae are formed about 1st March and the adults appear about the middle of the month and remain in evidence until about the middle of June. Their sudden appearance is probably due to the fact that immediately after emergence they find their way to the opening flower and leaf-buds and remain hidden there until disturbed; this is especially true if the weather is chilly or wet. Extensive observations on the distribution of the pupae were made in turf and cultivated areas, and as a rule very few individuals were found where the orchard was kept under turf. None were taken in open ground, nor were they found

among young trees. Detailed descriptions of all stages of this insect are given. The original food-plant or plants are not known, but the adults feed on apple, prune, cherry, pear, quince, peach, plum, wild crab-apple, hawthorn, currant, gooseberry, and hazel. Other deciduous trees are fed upon to some extent, especially willow. Cultural methods of control do not seem to be of any avail, as the insects prefer cultivated to uncultivated ground ; turning the larvae or the pupae to the surface during winter and early spring is barely possible, owing to the depths to which they penetrate, and though keeping the orchard under turf might discourage egg-deposition, this practice might be detrimental to the trees. Spraying has not yet been found to be profitable, as the injury seems insufficient to warrant the cost of a spray that would destroy the beetles, though, according to growers, this insect is causing more damage each year. Arsenate of lead at ordinary strengths is not of much value. In strengths of 4 lb. to 50 U.S. ($41\frac{1}{2}$ Impl.) gallons of water, it will kill the beetles if they eat it, but it has been noticed that they avoid parts heavily coated with spray. In the case of apple, this spray may be applied with the pink scab spray ; with pears, cherries, and other fruits, just after the petals fall. Lime-sulphur and Bordeaux mixture are more or less useful as deterrents, but do not warrant practical applications for control of this pest. Young grafts may be covered with cheese-cloth sacks from April to mid-June.

WILSON (H. F.) & MOZNETTE (G. F.). **The Bud Moth, *Tmetocera ocellana*, Schiff.** ; pp. 102–108, 5 figs., 1 table.

A brief summary of the distribution and history of *Eucosma* (*Tmetocera*) *ocellana* is given. About 1st April, the young larvae begin to feed on the tissues inside the opening flower and leaf-buds of pear, apple, prune, cherry, etc., frequently stopping further development. A short tunnel is often made in the centre of the shoot itself, causing the twig to die back for several inches, this form of injury being sometimes taken for fire-blight. The later larvae do not burrow in at the base of the buds, but work into the centre of opening buds and mat them together with silken threads, the adjoining flowers and leaves being eventually fastened in a nest, within which the insect remains when not feeding. In older trees, all injured twigs can be pruned out, but on young trees one or more of the main branches may be sufficiently injured to spoil the uniformity of the head. The larvae, which appear in spring, develop into moths by June. Eggs are laid in June and July and the young larvae begin to hatch in July, when, instead of gathering the leaves together in a nest, they feed on the underside of the leaf next to the main rib and larger veins. The upper leaf-surface is not eaten. In September, the larvae all make their way to the twigs and build cocoons in which they hibernate. At Corvallis, Oregon, there is only one generation each year. Each stage of the insect is described at length.

There is a choice of three spraying periods : first, in the spring ; second, in the summer ; and third, about 1st September. In the case of apples and pears, the sprays as applied for codling moth, should suffice for bud moth, if the undersides of the leaves are wetted. The applications made about 25th June for the first generation of codling

moths, and 1st–10th August for the second, are the best. On cherry trees, it is usually necessary to spray for sawflies, both the first and second generations. If lead arsenate be used, it should be applied to both surfaces of the leaves; a great many larvae may thus be poisoned, but it may sometimes be necessary to make a special spring application. It is usually considered that more good can be secured from an application made on 1st September; this applies to all kinds of fruit trees. Three enemies of *E. ocellana* are recorded: an undetermined Carabid beetle found feeding on the larvae; an undetermined species of *Triphleps*; and a mite, *Anystis agilis*, Banks. The paper concludes with descriptions of experiments made to ascertain whether the spray solutions employed could be used against the hibernating stage, from which it is thought that the oil sprays, as ordinarily used, are not efficient against the bud moth.

WILSON (H. F.). **The Fruit-Tree Leaf Roller,** *Archips argyrospila,* **Walker**; pp. 109–112, 3 figs.

Observations indicate that in Oregon there is but a single generation of *A. argyrospila* and that the life-history is practically the same as in New York State. This insect [see this *Review*, Ser. A, i, p. 225; ii, p. 14] has not yet been so serious a pest in Oregon as in Colorado, California and New York. In Oregon, most damage is done to the fruit, in which large holes are sometimes eaten by the larvae. As the majority of the egg-masses are formed on the smaller branches and twigs, a great many are disposed of by winter pruning, though enough are sometimes left on the trees to cause serious trouble, and it may become necessary to make regular spray applications. About the time the buds are opening in spring, a 10 per cent. solution of crude oil emulsion should be applied; if the eggs are found to be hatching earlier, it will be necessary to make the application earlier. Should the oil for any reason fail to kill the eggs, an application of arsenate of lead, 2 to 50, [? 2 lb. to 50 U.S. gallons] should be made just before the blossoms open.

WILSON (H. F.). **The Peach and Prune Twig Borer,** *Anarsia lineatella,* **Zeller**; pp. 113–118, 6 figs., 1 table.

Weldon has already suggested [see this *Review*, Ser. A, ii, p. 663] that there is but a single, long-drawn-out generation of *A. lineatella* each year; this corresponds with the conditions at Corvallis, but in Eastern and Southern Oregon there appear to be two or three generations. The insect bores down the centre of the twigs, and later, into the fruit, and if the larvae are abundant, the damage may cause as high a loss as 75 per cent. of the crop. The nature of the injury both to twigs and fruit is described at length, as well as the various stages. In the neighbourhood of Corvallis, larvae may be found in the hibernating burrows from late June till April or May of the year following. Shortly after hatching the young larvae crawl down to the rough bark in the crotches of twigs and limbs, and burrow down into the bark, apparently feeding as they go. During the late summer and winter months the larvae do not feed. Upon leaving the burrows in spring, the larvae crawl to the base of a bud or between the opening leaves and begin boring down the centre of the twig, wandering from

twig to twig and feeding a little in each. Many of them pupate in the dead leaves found fastened at the tip of the twig. The duration of the larval stage at Corvallis is from 10 to 11 months, and of the pupal stage, from 8 to 12 days. The results of spraying experiments conducted in 1914 are given in a table, and after an application of arsenate of lead, 2–50, and lime-sulphur, 1–12, only 0·1 of the buds were destroyed by the pest. Contrary to the opinion of W. T. Clarke (*Cal. Agric. Expt. Sta.*, Bull. 144, 1902), who recommends the application in the spring just as the buds are swelling, it was found that the lime-sulphur is effective at any time until the buds open.

WILSON (H. F.). **An Apple Leaf Miner, *Phyllonorycter* (*Lithocolletis*) *crataegella*, Clem.**; pp. 119–120, 1 fig.

This insect is quite common throughout the orchards of Western Oregon, where it has become well established on the apple; apparently its native food-plants are the native hawthorn and wild crab-apple. Hundreds of leaves on a single tree may have from one to a dozen mines, but exactly how much injury results cannot be estimated. Although the vitality of the trees must be more or less decreased, it does not seem that they have suffered in any appreciable degree. The mines vary in size and, except that they are always included between two of the larger cross veins, are not at all regular. The number of generations a year is not definitely known, but if the supposition that there are two be correct, the winter is spent in the pupal stage and the adults emerge in the spring. The eggs are probably laid on the underside of the leaves, and pupation apparently occurs within the leaf. Control measures, so far as known at present, consist of ploughing the dead leaves under so as to bury the pupae deep enough to prevent the emergence of the adults. Arsenate of lead, applied to the under sides of the leaves, may prove efficient, but it is not thought that this insect is a sufficiently serious pest to warrant special spraying.

WILSON (H. F.). **A New Cherry Pest, *Simplemphytus pacificus*, MacGillivray**; pp. 121–122, 1 fig.

This sawfly has only recently been discovered [see this *Review*, Ser. A, iii, p. 77] and very little is known of its life-history. During the winter of 1913, it was said to be causing some little damage to cherry trees, but it was found that, while some damage might result from the burrows made, the insect in itself was not a serious pest, the chief danger being from such fungus diseases as may settle in the open burrows after the insect emerges. Continued studies show that the larvae bore down the pith of stubs left from pruning, and except in cases where the stubs are short, they do not bore below the junction of the nearest branch. Where the stubs are longer than the pupating burrow, the insect does not work down to the first shoot. Knowledge of the habits of this insect begins with its migration to the cherry stub in the autumn; as the insect is always found with its head towards the opening, and as the burrow is only slightly larger than the insect itself, the insect must make the burrow and then back into it. After turning about in the burrow, the insect, now a mature larva, constructs a partition across the burrow just beyond its head; this partition

appears to be composed of silk and particles of frass. They remain in the larval stage until the end of February, when pupation begins, and the adults emerge in March. MacGillivray's description of the adult is appended.

WILSON (H. F.). **Injurious Gall Mites**; pp. 123–126, 4 figs.

Four species of gall-mites found in Oregon are considered in this paper: viz., *Eriophyes pyri*, Pagst., (pear-leaf blister mite), *E. vitis*, Land., (grape-leaf mite), *E. tristriatus*, var. *erineus*, Nal., (walnut-leaf mite) and *E. avellanae*, Nal., (filbert-bud mite).

E. pyri winters about the bud scales of the plant's young growth, usually about the second or third scale from the outside. When abundant, they are found in colonies of fifty individuals or more, protected by the pubescence which is usually present. As the buds swell and the leaves open, the adults spread over the under surface of the leaves and each female burrows through the epidermis and into the parenchyma of the leaf, where it deposits its eggs. As the young develop they extend the channels in all directions, causing the development of a corky growth. Throughout the season the adults are spreading over the leaf-surface and forming other galleries, with the result that in summer or autumn the leaf may be one mass of these blisters. In such cases, the vitality of the tree is seriously impaired. The spots caused by this mite resemble very closely those formed by various fungi, but examination with a lens of the under side of the leaf will reveal a small round hole leading to the burrow within, which is characteristic of all mite blisters. This mite attacks the leaves not only of the pear, but of apple, hawthorn, quince and other trees. No serious injury is done to these, although a closely related species is beginning to work on the apple in the eastern United States. The results obtained in the North-west by spraying with lime-sulphur just before the buds start, have been quite satisfactory. Probably, when spraying for these insects alone, better results would be obtained by spraying at the time when the mites are migrating from the leaves to the buds. Experiments conducted in New York indicate that the best results are obtained by using an oil spray such as Scalecide, distillate, or kerosene emulsion. The author has always recommended lime-sulphur, winter strength.

Specimens of leaves containing galls of *E. vitis* were received with a note to the effect that the vines were badly infested, but apparently not suffering to any extent. Nothing is known of its life-history, but the mites almost certainly hibernate as nymphs or adults about the bud scales or under loose bark. They should therefore be easily destroyed by lime-sulphur or an oil emulsion spray applied during the dormant season, or just as the buds are swelling in the spring. This species works on the under side of the leaf and causes the upper surface to become distorted with a series of swellings. On the lower side of the leaf opposite these swellings, numerous fine pubescent hairs are caused to grow, which form a felt like layer. On account of this, this type of gall is commonly known as a felt gall.

E. tristriatus, var. *erineus*, another erinose or felt mite, attacks the leaves and nuts of the English walnut, but as the life history and habits are probably the same as those of *E. vitis*, lime-sulphur applied

in the spring will probably prove to be an efficient remedy. The gall of this species resembles that of *E. vitis*, but the lower surfaces are not as abundantly felted, and the felt is white instead of brown. The galled areas are more distinctly outlined with this mite and the small cross-veins form distinct cross ridges between the larger veins.

E. avellanae has not previously been reported from Oregon, and on account of the manner in which it works and the time when migration takes place, it is likely to prove a very serious pest of cultivated filberts in this state. The galls may be found at all times of the year, but are less in evidence during the later part of the summer, since the mites are said to emigrate from the old buds to the new during the middle of the summer. By causing the gall formation, the growth of the buds attacked is destroyed and the leaves and catkins do not unfold. No efforts have been made to determine a remedy, but on account of the mites being protected by the bud scales, winter treatment is not likely to prove effective.

An example of the injury by each of the four mites is figured.

WILSON (H. F.). **Insect Pests of Stored Products**; pp. 127–130. 1 fig.

The greater part of this paper is devoted to a short study of the life-history, control, etc., of *Plodia interpunctella*, Hübn., the Indian meal moth; a description of *Silvanus surinamensis*, L., the saw-toothed grain-beetle, is also given, and these two are said to be the most important pests of stored vegetables, dried fruits, grains, cereals and nuts in Oregon. The following list of other pests of stored products in Oregon concludes the paper:—

Cathartus gemellatus, Duv., (square-necked grain-beetle), *Calandra granaria*, L., (granary weevil), *C. oryzae*, L., (rice weevil), *Bruchus* (*Laria*) *pisorum*, L., (pea weevil), *Acanthoscelides obtectus*, Say, (bean weevil), *Lasioderma serricorne*, F., (cigarette beetle), *Sitotroga cereallella*, Oliv., (Angumois grain moth), *Tyroglyphus lintneri*, Osb., (cheese mite), *T. farinae*, De G. (flour mite), and a mite found working in refuse grain and flour, which, according to Ewing, is a new species.

WILSON (H. F.). **The Thistle Butterfly,** *Vanessa cardui*, **L.**; pp. 131–132, 1 fig.

During the season of 1914, this insect was exceedingly abundant throughout Oregon, working on the Russian thistle. Many inquiries have been made by farmers with the hope that an efficient means of eradicating the thistles might result from the work of the caterpillar, but it is not thought that the larvae are ever likely to become sufficiently plentiful to be of much value in this respect, and any efforts that are being made to keep down the thistles, should not be discontinued. There are probably two broods in Oregon, the first occurring during June, July, and early August, and the second during August and September.

WILSON (H. F.). **Grasshoppers in Oregon**; pp. 133–136, 2 figs.

During 1913 and 1914, several species of grasshoppers have been extremely injurious in Oregon, and owing to the more favourable conditions that prevailed, have caused large losses in the southern,

central, and eastern parts of the State, where entire fields, many acres in extent, were rendered absolutely bare of vegetation. This condition was brought about by the grain being checked by frost early in the spring and when it was about four or five inches high, an invasion of the young nymphs of *Camnula pellucida*, Scudder, and *Melanoplus atlantis*, Riley, utterly destroyed the crop, not a blade of grain being left. In hay lands, the grasshoppers developed on high ground, and as soon as the irrigation water was removed, they moved on to the more tender grass, in many cases causing a loss from 25 to 50 per cent. of the hay crop. Large areas of pasture land have also been badly damaged in the same way. Young orchards were badly injured and in a number of cases the trees were entirely defoliated. In the lucerne-growing sections of Oregon, the crop was materially reduced. Details are given of an invasion of grasshoppers, and on 1st July 1914, a consultation was held for the purpose of determining upon a plan for destroying the migrating host, which was then travelling across the fields and making great inroads upon the crops. Most of the grasshoppers present were still in the nymphal stage, though a number were winged. The unwinged individuals were held in check on certain fields by the large drainage ditches, and millions had been driven into these and destroyed. A series of experiments were carried out to determine the best combination of poison bran to use, and the best time and method of application. Three combinations were made up and in each case enough water was added to make a crumbly mash. The use of oranges and lemons [see this *Review*, Ser. A, ii, pp. 249 and 542] was considered as too expensive, and although each combination was about as attractive as the others, the following one (containing lemon extract instead of the fruit) attracted a greater number of grasshoppers in a shorter time: Bran 50 lb.; Paris green, 1 lb.; salt, 1 lb.; and lemon extract, 1 oz. According to the number of grasshoppers found dead in the immediate vicinity of the bait, one pound of Paris green seemed to be as efficient as two. The best results were obtained by spreading the bait early in the morning before the dew was off the grass. Following these experiments, a meeting of growers was held, and based upon the recommended use of 10 lb. of bait per acre, a certain amount was assessed to each grower, depending upon his acreage. The grasshoppers began to die within a day or two of the application, and within a week were only present in limited numbers, millions of them being dead in the treated fields. The two species causing the greater part of the damage were *C. pellucida* and *M. atlantis*. *Anabrus simplex*, Hald., *Steiroxys borealis*, Scudder, and *Pseudotrimerotropis* (*Trimerotropis*) *cincolata*, Scudder, were also plentiful, while in western Oregon, *Melanoplus femur-rubrum*, Harr., is the most serious grasshopper pest.

Disking or ploughing in the autumn or early spring to destroy the eggs, is the most satisfactory method of control other than the poison bran-mash. The hopper-dozer has given satisfaction only in isolated cases, and those growers who have tried the poison bait broadcast are strongly favourable to that method and will follow it next season (1915). Two parasites attack grasshoppers in Oregon, viz., a red mite, probably *Trombidium locustarum*, Riley, and a fly, *Sarcophaga kellyi*, Aldrich [see this *Review*, Ser. A, iii, p. 81.] The former may be found on the grasshoppers all through the summer, and in one case over 100 mites were counted in various stages on a single individual.

WILSON (H. F.). **Insecticide Investigations of 1914 (Preliminary);** pp. 137–140, 2 tables.

In these experiments a number of chemicals—lead hydrogen arsenate, basic lead arsenate, ferrous arsenate, arsenic bisulphide, arsenic tersulphide, and copper arsenate—have given sufficiently satisfactory results as practical insecticides to warrant further experimentation. Both arsenates of lead, when properly prepared and used alone, may be used with safety, so far as injury to fruit and foliage is concerned. Arsenite of zinc so injured the foliage that every leaf fell. Under North-west conditions, it is more or less unsafe to combine any arsenical spray with lime-sulphur, since injury is liable to follow such combinations, of which seven are listed in a table. Bordeaux mixture may be combined with Black Leaf-40 without causing foliage injury or loss of efficiency as an insecticide. The solid matters obtained from a mixture of arsenate of lead and lime-sulphur do not appear to be responsible for the injury which results from this combination when the liquid and solid parts are applied as one.

Experiments carried on with crude oil-emulsion and distillate oil-emulsion, to determine the effect on trees, show that even ten applications in one season tend to improve the health of the sprayed trees rather than otherwise. Experiments with soluble sulphur show that this material is an effective insecticide against San José scale and some other insects, while experiments conducted with "Agfa" weevil oil and "Antimot," two preparations of the Berlin Aniline Works of New York, show that these substances are not efficient fumigants against insect pests.

LOVETT (A. L.). **The Variegated Cutworm,** *Peridroma margaritosa saucia,* **Hübn.**; pp. 141–149, 2 plates, 3 figs.

During the summer of 1914, a serious outbreak of cutworms occurred throughout western and northern Oregon. Practically every type of crop was attacked; truck and garden crops suffered most, but the injury to the buds and fruit of trees and bushes, to field crops, and to ornamental shrubs and plants was serious. The injury became most pronounced in early July; it had reached its maximum by early August and then rapidly subsided. The cutworm causing the greater part of the damage was *Lycophotia margaritosa saucia.* In the course of a summary of the recent history of this species in the North-west United States, it is stated that Professor F. H. Chittenden estimated the total injury due to this pest at 2,500,000 dollars. A life-history for Oregon conditions is given, as well as a description of each stage. Of the cutworms collected in clover in one locality on 22nd July 1914, nearly 80 per cent. were parasitised by Tachinid flies; the majority of these were *Phorocera saundersii,* Will.; *Euphorocera claripennis,* Will., was also present, as well as several species of ICHNEUMONIDAE. Other natural enemies of *L. saucia* include predaceous beetles, several species of birds, domestic fowls, and pigs. Amongst the usual control methods recommended, perhaps poison bran-mash, broadcast over the soil in the spring before the crop is up, is the best.

A short account is also given of *Hadena* (*Dargida*) *procincta,* Grote, (olive-green cutworm), specimens of which were received in July 1914, with the report that they occurred in great numbers in meadow lands.

This species has not been observed feeding on other plants than grass, but as greater areas are devoted to cultivated crops, and the amount of their natural food-plant is in consequence diminished, it may later become a pest of cultivated crops. The very limited observations made on the larvae show them to be gregarious in habit, with tendencies towards the army-worm type. In 1912, specimens of larvae of what is believed to be this species were received with the report that they were travelling in hordes across a cleared area. This species undoubtedly passes the winter as a larva. Adult moths have been collected at Corvallis in May, June, August, September, and November. There are undoubtedly three generations a year. Control methods are the same as for the variegated cutworm (*Lycophotia saucia*).

LOVETT (A. L.). **The Rose Curculio, *Rhynchites bicolor*, Fab., injures Blackberry Buds**; pp. 150–153, 1 fig,, 1 plate.

Rhynchites bicolor, F., (the rose curculio) has long been recognised as a serious pest of roses, though it is difficult to estimate the annual loss in Oregon. Recent observations seem to show that it may become a serious pest of cane fruit. In May 1912, near Russellville, Oregon, the flower buds of the blackberry were to be found severely injured by this weevil. Loganberries and raspberries were growing in adjacent plots, but did not show any indication of attack. In 1913 and 1914 the injury was reported to be as serious as in the preceding year, or slightly more so, the total injury affecting from one-half to two-thirds of the buds. The curculio also attacks the clusters of tender unfolding leaves. No really satisfactory control measures are known. Advantage may be taken of the adults' tendency to drop when disturbed, and they may be jarred from the plant into a container. This is of value only under certain conditions. At best it should be supplemented by the eradication of wild rose bushes in the vicinity, where practicable; by hand-picking and destruction of punctured seed pods; and by the use of sprays. A spray of 1 lb. of lead arsenate in 20 U.S. (16·65 Impl.) gallons of water should be applied on the first appearance of the beetles in May. As the blossoms of the rose advance, or the berries of cane fruit become of some size, the use of an arsenate should be discontinued. A spray consisting of 1 ounce of white hellebore powder to 3 U.S. gallons of water may be used. This spray is practically colourless and is non-poisonous to human beings. Fresh, pure hellebore is necessary. The insect appears to pass the winter in the soil as a pupa, and if this is the case, a thorough stirring of the soil about the plants during late September and October, and also in the early spring, should be of value in destroying the pupae. Attempts hitherto made to work out the life-history of this insect have been unsuccessful. Adult weevils occur from late spring until late summer and early autumn. Eggs have been found from May until late July. All evidence goes to show that only a small percentage of the eggs ever hatch. Of the eggs collected in the blackberry flower-buds, less than 6 per cent. hatched, and the young grubs did not feed at all in the dead buds. The egg-stage lasts about 20 days. Rose seed-pods were found in late August and September containing all stages, from the very small to the full-grown grubs. Other seed-pods were found at this time with all the inner portions devoured, leaving only the hard outer shell, from

which the larvae had disappeared. All efforts to obtain pupae were unsuccessful. The insect is believed to be one-brooded in Oregon and the adults seem to emerge from the hibernating pupae in the soil. A brief description of the adult, larva, and egg is given and the paper concludes with a bibliography of 14 works.

LOVETT (A. L.). **The Radish Weevil, a New Pest,** *Cleonus sparsus*, **Lec.**; pp. 154–156, 1 plate.

Radishes and turnips have been found infested by the grubs of *Cleonus sparsus*, Lec., the adults of which probably feed normally on the foliage of some native plant. The larvae tunnel inside the radish, devouring the whole interior of a small plant. When mature, they come to the exterior, work out a longitudinal groove on the side of the radish, and cover it over with particles of earth glued together forming a chamber. The eggs, which hatch out in July, are deposited directly on the skin of the root. The first pupa was observed on the 24th July, and the first adult on 4th August. Mature larvae and pupae were found in the field as late as 28th August, the grubs being in the chamber on the side of the root. The majority of the weevils observed in the field on 18th November are in these pupal chambers, where they probably remain inactive until early spring. An occasional empty cell indicates that a few beetles emerge in autumn. This agrees very well with the habits of *Bothynoderes* (*Cleonus*) *punctiventris*, the Russian sugar-beet pest. No control has been attempted so far, as the food habits of the adult are as yet unknown. The usual controls for *B.punctiventris* are enumerated, and a description of the egg, larva, pupa, and adult of *C. sparsus* is given. Regarding other species of *Cleonus*, *C. quadrilineatus* has been recorded as breeding on *Arogallus lamberti* in Colorado, *C. canescens* as injuring the buds and foliage of young peach trees in Colorado, and *C. calandroides*, which forms similar pupal chambers to *C. sparsus*, as attacking the roots of *Cakili edentula* in Maryland.

LOVETT (A. L.). **Clover Seed Injured by Midge,** *Dasyneura leguminicola*, **Lint.**; pp. 157–158.

From about Lebanon, Oregon, immature clover heads were received which were swarming with the small salmon-pink maggots of the Cecidomyid, *Perrisia* (*Dasyneura*) *leguminicola* (the clover seed midge), although the field had been pastured in the early season, and clipped off in early May, a practice which is usually a sufficient protection against this insect. Where this pest is abundant, the clover heads turn brown prematurely and appear blighted, and upon opening the seed capsules, the maggots, which should not be mistaken for scarlet red thrips, are exposed. The adults appear about the normal period of blooming of the clover, in the opening florets of which its eggs are laid. The maggot feeds in the unfertilised ovule until mature, when it drops to the ground, and there spins a minute silk cocoon. The second generation of midges is usually present about the time the second or seed crop of clover begins to bloom; the cocoons of this generation are spun a little below ground and the winter is passed in them. The most feasible method of reducing injury is afforded by some practice which will change the normal time of blooming.

All clover and lucerne along the fence rows and irrigation ditches should receive attention, as they otherwise offer ideal breeding grounds for the insect. *Bruchophagus funebris*, Haw., (the clover seed chalcid) attacks the seed of both clover and lucerne, doing the more serious injury to the latter in the eastern part of Oregon. There are two generations, one for each crop of clover heads. Those of the second pass the winter in the stored seed and emerge in spring. *B. funebris* may be controlled by the same measures as *P. leguminicola*.

Lovett (A. L.). **Nematode Gallworms or Eelworms,** ***Heterodera radicicola*****, Müll.**; pp. 159–165, 4 figs.

Heterodera radicicola, Müll., attacks over 450 different plants. Notes are given on its distribution, means of spread, injury, and control measures [see this *Review*, Ser. A, iii, pp. 123 and 177]. During April, a case of serious nematode injury to 48 tomato plants in a greenhouse provided an opportunity for experimenting with formaldehyde (1 part 40 per cent. formaldehyde in 99 parts water) and ammonia water (1 part concentrated commercial ammonia in 99 parts water). One half of the frame of tomatoes was treated with formaldehyde and the other half with the ammonia water. Each plant was surrounded by a small circular trench into which 1 gallon of solution was poured and allowed to soak into the roots. The formaldehyde killed most of the plants to which it was applied, whilst at the close of the test most of those treated with ammonia water seemed entirely free from the effects of nematode injury and to be growing well and producing fruit. This success warrants further trials. In a great many cases the annual replacing of infested soil in the greenhouse by fresh soil will prove a useful practice. The old soil should be spread on a hard road or other position where it can dry out without spreading the trouble. Steam sterilisation is advocated where conditions permit the installation of the necessary apparatus. A bibliography of seven works concludes this article.

Lovett (A. L.). **Tipulid Work in Prune Wood.**—*Ctenophora angustipennis*, **Loew**; pp. 166–169, 1 fig., 1 plate.

In March 1914, the larvae of *Ctenophora angustipennis* were observed tunnelling in the decayed wood of prune in an orchard near Corvallis. Though secondary, the work of the Tipulid larvae would certainly aid in killing the infested trees. The larval tunnels extend from above downward with long curves; they are from 8 to 26 inches in length, from 1 to $2\frac{1}{2}$ inches in diameter, and nearly filled with frass. The mature larvae and pupae were usually found at the bottom of the tunnel. The work of the insect through the deadened wood affords more ready entrance for the moisture from the winter rains. The frass helps to hold this moisture and thus assists decay. An allied species, *C. apicata*, O.S., was reported in 1909 from Maine, as working in the decayed wood of the elm. There is probably one generation a year. The adults appear during late March and April. The female probably lives from 4 to 10 days and deposits from 200 to 400 eggs, most likely in cracks in the dead wood. The larvae hatch out in

from 9 to 17 days. The pupal stage lasts about 10 days. A description is given of the various stages. While no control work has been undertaken, it would appear that the careful dressing of wounds and the painting over or otherwise protecting all large scars or bruises on trees would be an advisable precautionary measure.

LOVETT (A. L.). **The Tomato Worms,** *Phlegethontius sexta,* **Johan.,** *Phlegethontius quinquemaculata,* **Haw.**; pp. 170–172, 1 fig., 1 plate.

Two species of horn-worms, *Protoparce* (*Phlegethontius*) *sexta*, Johan., (the tomato worm), and *P. quinquemaculata*, Haw. (the tobacco worm), attack tomato and potato foliage in Oregon. Usually of no special economic importance, these insects caused more or less serious injury in various parts of the State in 1914, and in some cases large areas of potatoes were defoliated and whole plantings of tomatoes were practically ruined. Tomato, potato, egg-plant, tobacco, and various other Solanaceae form the major part of the food of these caterpillars. Specimens of *P. sexta*, received from Salem, Oregon, were reported as feeding on cherry foliage, and others of *P. quinquemaculata* were collected near Redmond, feeding on poplar. Hand-picking of the caterpillars, or knocking them into a pan full of soapsuds, are useful measures where their numbers are limited. Otherwise, dusting with acid arsenate of lead must be resorted to [see this *Review*, Ser. A, ii, p. 602]. Deep ploughing in autumn or early spring will destroy many larvae hibernating at a depth of from 2 to 4 inches. Turkeys allowed to range over an infested field will do efficient service. From Specimens of *P. quinquemaculata* larvae sent in this summer a great number of Tachinid flies emerged. These have been identified as *Sturmia inquinata*, Wied. Mature caterpillars have been found parasitised by *Apanteles congregatus*, and they are also attacked by a bacterial disease.

GENTNER (L. G.). **The Antique or Rusty Tussock Moth,** *Notolophus antiqua,* **Linn.**; pp. 173–180, 1 fig., 1 plate.

In the course of an investigation into the life-history and contro of *Orgyia* (*Notolophus*) *antiqua*, L. (the antique or rusty tussock moth), the development of a third complete generation from one of the egg-masses used in the laboratory was observed, and evidence of apparently parthenogenetic development was obtained, though Barnard's statement that all members of winter broods are females, was found to be incorrect. This moth was probably introduced into the United States from Europe on imported fruit trees, and has gradually spread through the northern States from the Atlantic to the Pacific, and also into Canada. The larvae feed upon the foliage of almost every kind of tree, shrub, or herbaceous plant, both in Europe and America. In Oregon, it feeds principally on apple, pear, cherry, and other fruit trees. Two parasites of this pest, a Tachinid and the Ichneumon, *Pimpla inquisitor*, were reported by Woods in 1906, the latter parasite being said to destroy whole colonies in the pupal stage. *Telenomus orgyiae* attacks the eggs, and during 1914 a number of the female pupae at Corvallis were found infested by the larvae of the Pteromalid, *Dibrachys boucheanus*, Ratz. In winter the egg-masses may be easily

found attached to the trees or on dead leaves. They may then be collected and destroyed. When very numerous, the larvae may be jarred from the trees and prevented from returning by placing sticky bands around the trunks. It has been observed in Oregon that this insect does not become a serious pest where the orchards are regularly sprayed with arsenicals. The best time to spray is when the larvae are newly hatched ; the larger the larvae become, the more resistant they are to the poison. Arsenate of lead, 4 lb. to 50 U.S. galls. (41½ Impl.) water, is the strength recommended where ordinary strength sprays prove ineffective. A bibliography of 43 works, dating from 1758, concludes this paper.

MOZNETTE (G. F.). **The Brown Lacewing,** *Hemerobius pacificus,* **Banks ; pp. 181–183, 1 fig.**

Hemerobius pacificus, Banks (the brown lacewing), is distributed over the Pacific Coast regions. It is an important economic species in California, and is also found in the States of Washington, New Mexico, Arizona, and in British Columbia. Its larvae prey upon almost all species of Aphids, mites, and probably upon other soft-bodied insects. It has been found to be particularly important in destroying the oviparous females of *Aphis sorbi*, Kalt., (the rosy apple aphis), and *Myzus ribis*, Linn., (the currant aphis). During July 1913, it was abundant in hop-gardens, feeding upon the wingless females of the summer generation of *Phorodon humuli*, Schrank (the hop aphis), and also on *Tetranychus telarius*, Linn. (the red spider-mite). On 3rd November 1913, numerous eggs and larvae were found among colonies of *Aphis sorbi* on apple trees in the experimental orchard of the Agricultural College at Corvallis. The eggs are laid singly on the lower surface of the leaves, mostly near the midrib and lateral veins, or in the axil of the two. The egg stage lasts nine days, and the larval one averages 14 days. When ready to pupate, the larva usually seeks some crevice in the bark, although cocoons were found in clustered leaves of apple curled by aphids, on the under surface of the leaves of currant and hop vines, and in anthracnose cankers. The adults, when confined in breeding cages, do not live for more than three or four days. According to experiments on five larvae, which were fed on aphids, the average number devoured by a single individual during its larval period was 201. The larva, pupa, and adult are briefly described.

CHILDS (L.). **The Alfalfa Looper,** *Plusia californica,* **as a Truck Crop Pest; pp. 184–188, 2 figs.**

Phytometra (*Plusia*) *californica* (the alfalfa looper) is normally held in complete subjection by its natural enemies. For some time past, however, truck crops have been severely injured in some localities, the damage to lettuce in Oregon being very noticeable during the summer of 1914. A study of its life-history and habits was conducted on a three-acre patch of lettuce, which was in a few days reduced to a condition in which it was valueless. The egg, larva, pupa, and adult are described. It has been reported from nearly all of the States

lying west of the Rocky Mountains and has also been recorded as feeding on lucerne, garden peas, mallow, cabbage, barley, elder and dock. There are apparently three complete generations a year. Five hymenopterous and two dipterous parasites including the Tachinid, *Plagia americana*, Wulp, normally keep this pest under complete control. Natural control is highly satisfactory with most field crops, but with garden produce, especially with vegetables of the lettuce type, the position is different, as even a very short attack renders lettuce useless. The following control methods are suggested :—The time of the insect's flight being determined by means of light traps—which are reported by most authors to attract the moths in large numbers—arsenicals in the form of dust or spray may be used against the young larvae which hatch from the eggs deposited by the adults. The insecticide must be applied as soon after the eggs hatch as possible and to do this a close watch must be kept on the garden. For lettuce, the best results will probably be obtained by using a good dust gun in the morning while the dew is still on the foliage. Arsenate of lead, 1 lb., and wood ashes (sifted), 20 lb., is a good dust mixture. Should the pest become troublesome the following formula, which is satisfactory in controlling the cabbage looper, is worthy of trial : Arsenate of lead, 1 lb., resin soap, 3 lb., water 50 U.S. gals ($41\frac{1}{2}$ Impl.). This spray should not be applied after the development of the head is well advanced, or just before cutting time. The burning or ploughing under of all materials about infested fields will destroy many hibernating insects. This valuable measure should be carried out before 1st March.

WILSON (H. F.) & CHILDS (L.). **The Rose Leaf-Hopper as a Fruit Pest,** *Empoa rosae*, **L. (A Preliminary Report)**; pp. 189–194, 5 figs.

The preliminary investigation of *Empoa rosae*, L. (the rose leaf-hopper) has shown that this insect, which normally feeds on rose and has not heretofore been considered of economic importance, is a serious pest of apple, strawberry, and several cane fruits. It evidently may be found throughout a greater portion of the temperate regions of North America, and has occasionally been noted feeding on apple foliage, but never sufficiently to warrant control. In the Pacific North-west it is, however, of primary importance as a pest of apple and strawberry, and to a less degree, of blackberry, loganberry, raspberry, and *Crataegus*. Adults have also been found feeding on the leaves of several other trees and shrubs, including cherry, prune, elm, oak, and currant. It would appear that these plants offer temporary food for the migrating forms in the absence of something more favourable. The rose is its favourite food-plant and is often attacked in such numbers that the development of the flowers is prevented. The chief injury is caused by the insects sucking the juices from the leaves. Yellowish, nearly circular spots on the under surface of the leaf are the first signs of injury. In several localities the leaves dropped prematurely in August. Another form of injury is the curling of the younger leaves, resembling greatly the characteristic injury of the green apple aphis. A third injury is due to the egg punctures made by the females in ovipositing. The winter is passed for the most part in the egg-stage on a variety of plants, such as wild and cultivated

roses, apple trees, strawberries, blackberry canes, etc. It is also likely that some of the adults live through the winter. The eggs hatch in the spring and the young nymphs find their way to the leaves of various food-plants and begin feeding. These nymphs reach the adult stage during June and July, and lay their eggs in the leaves of apple and possibly other plants. The adults from this generation of eggs reach maturity in the early autumn and produce the hibernating eggs. The nymph, adult, and egg are described. This insect has several insect and spider enemies, amongst which a very minute hymenopterous egg-parasite plays an important part. The larva of a green lacewing, *Chrysopa* sp., probably *californica*, preys upon the smaller nymphs, but occurs in such limited numbers as to be of little importance. A large dragonfly and a large Scatophagid fly have been captured feeding upon adult leaf-hoppers. Pruning will remove the eggs deposited towards the tips of the branches, but the remainder must be destroyed in some other way, perhaps with oil emulsions, but tobacco sprays promise to be the most practical. The time and method of application are, however, important factors. As the insects feed from the under side of the leaves, the spray must be adjusted so that the under side will receive a thorough coating of spray. The nymphs are more easily destroyed than the adults, as they cannot fly up and escape. A good formula is, Black Leaf 40, 1 in 1,500 ; whale oil soap, 1 lb. ; water, 50 U.S. gals. (41½ Impl.).

WILSON (H. F.). **Minor Insect Pests**; pp. 195–202, 8 figs.

The large, white grub of the Longicorn beetle, *Prionus californicus*, Mots., is found feeding on the small roots and the bark of the larger roots, of fruit trees, mostly in new ground where oak and fir stumps have not been entirely removed. The grubs may be found for a number of years after the orchard is started. The presence of this pest is usually unrecognised until dead trees have been taken out and the injury noticed on the roots. This usually occurs on trees from one to five years old. There is practically no way to deal with these grubs in the ground without treating the entire orchard, at a great and, in many cases, a useless cost, for they cannot be reached except with gases or repellents, and the latter do not seem to be effective. In cases where orchards are to be set out in land that has recently been in timber, it is suggested that pigs be pastured there, as they will destroy all of these grubs they find.

The bud weevils, *Sciopithes obscurus*, Horn, *Paraptochus sellatus*, Boh., *Thricolepis inornata*, Horn, sometimes appear on fruit trees in immense numbers and feed on the foliage and newly opened buds. The comparative damage is small on large trees, but very young ones may be seriously injured. Practically nothing is known of the life-history of the bud weevils, the adults being the only stage yet known. Arguing from closely related species, it is inferred that the larvae live in or on the roots of certain plants. Spraying is not practical, but a cheap and effective preventive would be to place some adhesive substance around the tree. Printer's ink would probably be the best for this ; a special preparation for the purpose is being made by the makers of " Tanglefoot " and may prove very effective. In the cool

of the day the tree should be jarred, when the insects will fall to the ground. The preventive may then be applied.

The bud click-beetle, *Limonius discoideus*, Lec., is one of the more serious of the insect pests of the North-west for which no immediate means of control are apparent. The chief injury is done to young trees, one to four years old, and pears seem to suffer more than others, although apples, plums, cherries, etc., are attacked to some extent. The adults feed on the half-opened leaf-buds in the spring, and ultimately cause stunting and deformity in the trees. Two years are probably required for the insect to pass through its complete life-history. The adults emerge in the spring about the time the leaf buds of pears are opening, and are abundant for three or four weeks. The females lay their eggs on or in the ground, and the young larvae feed on the roots of weeds and grasses. Arsenate of lead in strengths much greater than is necessary to kill other insects seems to have no effect on them. Cultural methods for the destruction of the larvae in the ground in and around the orchard would seem to offer the best means of relief, as they develop in large numbers in all orchard land that is left to produce vegetation of any kind in between the trees.

Though the blossom fly, *Bibio nervosus*, Lw., has often been reported as causing severe injury in the early spring when fruit trees are in blossom, and numerous field observations and microscopic studies of this insect and its mouth-parts have been made, the authors are unable to find any evidence of its causing the slightest injury. On the contrary it must be considered beneficial in that it distributes pollen from one blossom to another. A miner working under the skin of the apple, but not considered a serious pest at present, has been observed in various parts of the United States and specimens of this injury have been sent in from Western Oregon. So far as known to the authors, nothing has been ascertained regarding its habits, it has never been reared, and has not been given a scientific name. *Aphis cerasi*, F., (black cherry aphis) has for years been doing great damage to young trees, and spraying and dipping have not proved very successful. On the newly grafted parts the aphids may cause all kinds of deformity. A simple method of controlling this pest on first-season grafted or budded trees has been devised. It was noticed that where the scion was fastened on to the older stock, the top of the old tree was cut away before the aphids hatched out. The first generation, then, comes from eggs deposited on the stocks below the scion. In every case a number of buds appeared below the graft, and the newly hatched aphids collected on these. They were then easily destroyed by pinching off the buds on which they had settled. Two apple and pear Membracids, *Stictocephala inermis*, F., and *Ceresa basalis*, F., are quite common in and near the Willamette Valley. The injury done by these two leaf-hoppers is not serious, as the wounds heal up without leaving dead areas between the slits, as in the case of other species. Control measures are not considered necessary. *Diabrotica soror*, Lec., has already been reported as feeding on fruit trees and may possibly become a serious fruit pest, as well as a pest of garden and field crops. In the summer of 1914, prompt action probably stamped out at the initial point an outbreak of *Leptinotarsa decemlineata*, Say, in Union County.

NOTICES.

The Editor will be glad to receive prompt information as to the appearance of new pests, or of known pests in districts which have hitherto been free from them, and will welcome any suggestion the adoption of which would increase the usefulness of the Review.

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Bureau, are requested to communicate with the Assistant Editor, 27, Elvaston Place, Queen's Gate, London, S.W.

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SURFACE (H. A.). **Cyanide of Potassium in Trees.** [Correspondence.]—*Science, Philadelphia*, xl, no. 1041, 11th December 1914, pp. 852–853.

Growers are warned that the method of treating trees with cyanide of potassium [see this *Review*, Ser. A, iii, p. 73] has frequently resulted in the discoloration of the tissues or in the destruction of the trees and should only be employed after considerable experimentation.

BRUES (C. T.). **A Synonymic Catalogue of the Dipterous Family Phoridae.**—*Bull. Wisconsin Nat. Hist. Soc., Madison*, xii, nos. 3 and 4, December 1914. [Received March 1915.]

This catalogue gives a complete list of the species of PHORIDAE from all parts of the world.

SAUNDERS (A. P.). **The Cotton Worm Moth.**—*Science, Philadelphia*, xli, no. 1045, 8th January 1915, p. 65.

A correspondent states that in October 1912 the cotton worm moth, [*Alabama argillacea*, Hb.] suddenly appeared in tremendous numbers in Clinton, N.Y. A few days earlier an equally large swarm appeared in Ontario [see this *Review*, Ser. A, i, p. 169]. None were seen in Clinton in 1913 and only a few specimens in the autumn of 1914.

LOEB (J.). **The Simplest Constituents required for Growth and the Completion of the Life Cycle in an Insect** (*Drosophila*).—*Science, Philadelphia*, xli, no. 1048, 29th January 1915.

This is a record of experiments performed to find the source of nitrogenous compounds required for the growth of *Drosophila*. The larvae were able to manufacture all the complicated nitrogenous compounds of their body from one or two amino-acids or from one ammonium salt. Bacteria may have helped in the work of syntheses in these experiments, but 40 successive generations of *Drosophila* larvae have been raised aseptically on their natural vegetable food, the banana.

PIERCE (W. D.). **Descriptions of Some Weevils reared from Cotton in Peru.**—*U. S. Dept. Agric., Office of the Secretary, Washington, D.C.*, Report no. 102, 25th January 1915. 16 pp., 2 plates, 6 figs.

Included in this paper, are descriptions of the following BRUCHIDAE and weevils reared from cotton in Peru, though in one or two cases, there is some doubt as to the nature of their association with this plant :—

Bruchus (*Mylabris*) *peruanus*, sp. n., *Pachybruchus verticalis*, sp. n., *Spermophagus piurae*, sp. n., *Eustylomorphus squamipunctatus*, gen. et. sp. n., *Menetypus variegatus*, sp. n., *Anthonomus vestitus*, Boheman, *Sibinia peruana*, sp. n., *Gasterocercodes gossypii*, gen. et sp. n., and *Geraeus perscitus*, Herbst.

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HOPKINS (A. D.). **Contributions toward a Monograph of the Scolytid Beetles. II. Preliminary Classification of the Superfamily Scolytoidea.**—*U.S. Dept. Agric., Bur. Entom., Washington, D.C.*, Tech. Ser. no. 17, pt. ii, 9th January 1915, pp. 165–232, 8 plates, 17 figs.

In this paper on the Scolytid beetles of the world, their anatomy and the formation of their galleries are described at length, and a key is given to the families, of which four, the IPIDAE, SCOLYTIDAE, SCOLYTOPLATYPODIDAE, and the PLATYPODIDAE are recognised. A list of the genera and a bibliography of over 80 works are appended.

HOPKINS (A. D.). **Classification of the Cryphalinae, with descriptions of new genera and species.**—*U. S. Dept. Agric., Office of the Secretary, Washington, D.C.*, Report no. 99, 10th March 1915, 75 pp., 4 plates, 1 fig.

This report deals with the subfamily CRYPHALINAE of the family IPIDAE, which includes a group of ambrosia beetles, and gives descriptions of new species, many of which are of economic importance, as well as keys to the known genera and species.

JONES (P. R.). **Preliminary Report on Spraying of Eggs for the Control of the Purple and Green Apple Aphides of California.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iv, no. 1, January 1915, pp. 20–30, 1 table.

In these experiments during the season of 1914, a large number of nursery trees, heavily infested with the eggs of *Aphis pomi* (green apple aphis) and *A. sorbi* (purple apple aphis), were used. The results of several previous workers are reviewed, and the author's extensive experiments are detailed in a long six-page table.

So far as can be determined at present under western conditions, it is believed that dormant treatment for the eggs of these two aphids should be either commercial crude oil emulsion, 1 to 9 or 1 to 10 (where the concentrate contains about 85 per cent. crude oil); home-made crude oil emulsion from 10 to 15 per cent. strength made from a crude oil running 19° to 23° Bé.; commercial lime-sulphur at 1 to 6 or 1 to 7, the application being as late in the winter as possible, but before the buds begin to show green. If home-made distillate oil emulsions are used, they should be made from heavy distillate, and the dilution in the tank should consist of 7 or 8 per cent. oil.

The stock solution of home-made distillate oil emulsion (by volume) is: water, 2 parts; cresol soap, 5 parts; and distillate oil 26°–29° Bé., 25 parts.

Quarantine Order No. 26 (with Regulations): Mexican Cotton Boll-weevil.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iv, no. 1, January 1915, p. 45.

Anthonomus grandis, Boh. (Mexican cotton boll weevil) has not yet been recorded in California, but is known to exist in several of the United States. The main provisions of this order are as follows: The importation into California of cotton seed, grown in any of the

infested States, is prohibited and should any such cotton arrive, it must either be immediately sent out of the State or destroyed at the option and expense of the owner, consignee, or agent. Cotton seed from any locality can only be imported for actual cotton-growing experiments in amounts not exceeding 100 lb., and intending importers must first send full details to the State Commissioner of Horticulture for a permit. Railway trucks that have been used for the transportation of cotton, cotton lint, or cotton seed must, upon arrival in California, be thoroughly cleaned and such material removed and burned; all such trucks shall be amenable to all regulations of this order.

WHITNEY (B. B. and L. A.). **The New Zealand Peach Moth** (*Ctenopseustis obliquana*).—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iv, no. 1, January 1915, pp. 48–49, 2 figs.

This paper records the refusal at San Francisco, in April 1914, and deportation of a shipment of peaches grown in New Zealand on account of their being heavily infested with larvae of what proved to be *Ctenopseustis obliquana* (New Zealand peach moth), a native insect of New Zealand, where it is exceedingly injurious. Short descriptions of the larva, pupa and adult are given. The caterpillar invariably enters the fruit at the stem-end and works round into the pit, which often causes the fruit to split. Other larvae were observed apparently devouring the flesh and making deep cavities in the fruit, much reducing its commercial value. It is believed that if established in California, this insect would cause as much trouble as *Anarsia lineatella* (peach twig-borer).

Insect Notes.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iv, no. 1, January 1915, p. 53.

The twig-borer, *Polycaon confertus*, is reported as damaging prune trees, where prunings have been piled alongside the orchard and allowed to decay. The green apple aphis, *Aphis pomi*, De Geer, occurred in the winged and wingless forms on the remaining leaves of the apple trees, and eggs were in great numbers on the tips of the twigs on 30th November 1914, when snow was on the ground; at the same time and place, adults and eggs of *Bryobia pratensis*, Garm., (clover or almond mite) were observed in corresponding situations. Termites are reported to be damaging lemon trees, and a small scale, *Chionaspis* sp., as infesting cedar trees. *Lepidosaphes ulmi*, L. (oyster-shell scale) has been found on all shipments of boxwood trees from Holland inspected at San Francisco this season; this scale is a general feeder, attacking a great variety of trees, of which twelve are enumerated. *Icerya purchasi* is unusually abundant in several parts of the State and in one locality is becoming a serious pear pest; apparently *Vedalia* does not flourish on the scale with this host plant. *Aphis nerii* was seen on oleanders on 15th December, while *Rhopalosiphum arbuti* is quite common on manzanita, causing the tips of the tender leaves to curl and redden.

Urich (F. W.). **Entomologist's Report.**—*Minutes of the Meeting of the Trinidad Bd. Agric.*, no. 1, 20th January 1915, p. 3.

Thrips [*Heliothrips rubrocinctus*] have been practically in abeyance in the Sangre Grande district, though they may give trouble if a change of leaf occurs when the dry season commences, unless taken in hand early. On an estate in the heights of Arima, cacao beetles [*Stirastoma depressum*] were troublesome in a few isolated places exposed to sun and wind. Young trees supplied a few years ago appeared to suffer most and it might be well to spray or paint these with a solution of lead arsenate. At Chagunas an outbreak of caterpillars of the coconut beetle [*sic*] did some damage to young cultivation, doubtless owing to the absence there of their natural enemies, of which several species are found in Trinidad. The pest may be controlled by hand collection and subsequent burning. Attacks are sporadic and short-lived in Trinidad.

La lutte contre la mouche de l'olivier en Italie. [The control of the olive-fly in Italy.]—*Bull. bi-mens. Off. Gouv. Gén. Algérie, Paris*, xxi, no. 1, 1–15th January 1915, p. 6.

In Italy, a three years' test is being made of the Lotrionte method of olive-fly control [see this *Review*, Ser. A, ii, p. 577], but so far the results are exceedingly disappointing, the infestation amounting to 60 per cent. in one case and 100 per cent. in another. It is, however, stated that control was only begun rather late, which may have influenced the result.

Priego (J. M.). **Fruits and Nuts grown under Extensive Culture in Spain.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, vi, no. 1, January 1915, pp. 1–6.

Only a comparatively small part of this article is of entomological interest. *Ceroplastes rusci* (fig scale) is the only insect pest of the fig worthy of mention in Spain, where this plant is not much subject to the attack of insects. Amongst moths which attack the chestnut (*Castanea vesca*) may be mentioned *Cydia* (*Carpocapsa*) *splendana* in Catalonia and *Euproctis* (*Porthesia*) *chrysorrhoea* (brown-tail moth) in Andalusia and Avila. Diseases and pests of the almond are fairly numerous in Spain, but rarely do serious damage; the insects concerned are: *Aphis amygdali*, *Scolytus amygdali*, *C. splendana*, *Aglaope infausta*, *E. chrysorrhoea*, and *Aporia crataegi*; while the enemies of the carob (*Ceratonia siliqua*) are the scale, *Aspidiotus ceratoniae*, and the moth, *Zeuzera pyrina*. Pomegranates are said to be attacked only by an aphis.

Legendre (D.). **Note préliminaire sur un Diptère Parasite de la Pêche.** [Preliminary Note on a Dipteron attacking the Peach.]—*Bull. Econ. de Madagascar et Dépendances, Tananarive*, nos. 3 & 4, 1915, p. 242.

Ceratitis capitata is recorded for the first time from Madagascar, as seriously infesting the "malgache" peach. About 80 per cent. of these were attacked, while the Cape peach trees scarcely suffered,

owing probably to the fact that the fruit was a month earlier and had set before *C. capitata* had begun to oviposit. Mangoes and oranges are seldom attacked by *C. capitata*, presumably because the fly has finished its life-cycle when these fruits are ripe in March and April. These observations show that the early peach varieties, like those of the Cape, are more suitable than the later varieties for cultivation in Madagascar.

PIERCE (F. N.) & METCALFE (J. W.). **Descriptions of Three New Species of British Tortricidae.**—*Entom. Mthly. Mag., London*, li, no. 608, January 1915, pp. 8–11.

Cnephasia genitalana, sp. n., from Folkestone, *Poecilochroma pomedaxana*, sp. n., bred from larvae found feeding on old apple trees and once upon oak and reported to be confined to these trees, and *Lipoptycha aeratana*, sp. n., are described.

WALKER (J. J.). **Note on the Food of *Ptinus tectus*, Boield.**—*Entom. Mthly. Mag., London*, li, no. 608, January 1915, pp. 18–19.

A tin of chocolate powder is reported to have been found swarming with *Ptinus tectus*, Boield., in all its stages. This beetle is also recorded as breeding in and thriving on Cayenne pepper, stored in a chemist's shop at Nottingham.

DAY (F. H.). **Late Larvae of *Pieris brassicae*.**—*Entom. Mthly. Mag., London*, li, no. 608, January 1915, p. 19.

Pieris brassicae larvae are stated to have been feeding very late in 1914 in a garden at Carlisle ; examples collected from Brussels sprouts on 28th November pupated 8th December. These were quite free from Ichneumonid parasites, whereas some years ago 95 per cent. of these larvae, which the writer was attempting to rear, were infested with *Apanteles glomeratus*. It is suggested that this immunity from attack is due to the parasites' activity for the season having ended with the previous brood.

The Market Fruit Garden.—*Gardeners' Chron., London*, lvii, no, 1463, 9th January 1915, p. 15.

An attack of the currant root louse, identified by Theobald as a migrant form of *Schizoneura ulmi*, is recorded. This pest, which may easily be overlooked, even when prevalent, is found on the roots of young currant bushes. Infested roots should be dipped in a strong solution of soft soap.

HILEY (W. E.). **On the mode of infection of larch canker and the possible means of preventing it.**—*Qrtly. Jl. Forestry, London*, ix, no. 1, January 1915, pp. 7–17, 6 figs.

The infection of larch canker, *Dasyscypha* (*Peziza*) *calycina*, may be furthered by wounds of various kinds, and according to Massee, infection will follow if spores are placed on the excretion found in spring around the punctures of *Chermes abietis*, which bores through the cork into the living tissues beneath. Speyer concludes that the holes are too small to allow of the entry of the fungus germ tubes and there is little evidence that *Chermes* really encourages canker.

PETHERBRIDGE (F. R.). **Spraying for Apple Sucker and Leaf-curling Plum Aphis.**—*Jl. Bd. Agric., London*, xxi, no. 10, January 1915, pp. 915–919, 1 pl.

These experiments aimed at ascertaining which of the various late winter washes at present recommended would best control the attacks both of *Psylla mali* (the apple-sucker) and *Aphis pruni* (the plum aphis). The washes are divided into groups, containing respectively lime, sulphur, and salt ; lime and sulphur ; lime and salt ; lime, salt, and waterglass ; and lime, salt, and washing soda. The addition of waterglass to lime and salt did not increase the adhesive properties, and the addition of washing soda was apparently detrimental, as the deposit on the upper surface of the branches and twigs on this plot was washed off by the heavy rains soon after spraying. Of the washes applied early in March, the lime, salt and sulphur wash was the most successful in reducing *P. mali*, but even this was far from successful from the growers' point of view. The most noticeable difference between the untreated plot and those which had been sprayed was the healthy appearance of the leaves of the plum trees on the latter as compared with the curled leaves of the untreated plot. On all the sprayed plots the aphis was so reduced that summer spraying was unnecessary, and this, in an orchard where *A. pruni* has done a considerable amount of damage in former years. These observations are not in agreement with the conclusions of those observers who find that spraying with lime and salt, lime, salt and waterglass, or lime, salt and washing soda in early March is capable of keeping down apple-sucker. If experiments on these lines are recorded with the time of spraying, relative to the hatching of *P. mali*, and also with the amount of rain following the sprayings, it may be possible to determine why one experimenter is successful and another unsuccessful with the same wash.

As a result of these experiments, the author favours the lime, salt and sulphur wash, applied as late as possible previous to the hatching of the apple-suckers, for the dual purpose of reducing the two pests in question.

EALAND (C. A.). **Insects and Man.** *London:* Grant Richards, Ltd., 1915, 343 pp., 16 pls., 100 figs., 8vo. Price 12*s.*

This book does not claim to be more than a compilation, but it is well arranged and, though dealing with highly technical matters, presents a mass of interesting information in an attractive form. The relations of insects with plants, with disease in man and domestic animals and as beneficial agents and household pests, etc., are dealt with and a lengthy section discusses insect control. A little more than fifty pages is allotted to the insect pests of plants and a general review of the subject is given with examples of those of major importance such as locusts, pests of cotton, the periodical Cicada, the gipsy moth, scale-insects, the Hessian fly, the Mediterranean fruit fly and *Phylloxera*. The English reader may be surprised to find no mention of any important English insect plant-pests, the fact being that in this country though many exist, they are rather an annoyance than the cause of grave commercial loss. The illustrations, especially those from photographs, are well chosen. The book would be greatly improved by a fuller and more accurate index. Ten pages of bibliography, with references to over 200 works, are appended.

WILLIAMS (C. B.). **The Pea Thrips** (*Kakothrips robustus*)—*Ann. App. Biol., London*, i, nos. 3 & 4, January 1915, pp. 222-246, 12 figs.

In an account of the history of *K. robustus*, it is stated that the damage to peas in Germany, described by Kirchner in 1890 as due to *Thrips cerealium*, was in reality due to the former species. The synonomy of this species is discussed and it appears that *Thrips pisivora*, Westw., *T. physapus*, von Schilling, *Physopus robusta*, Uzel, *Euthrips robusta*, Bagnall, and *Frankliniella robusta*, Williams, are all synonyms of *K. robustus*. Detailed descriptions of all stages in the life-history are given, as well as a list of recorded localities in England, Wales, and Ireland. There is no record of its occurrence in Scotland, but in Europe it occurs in Bohemia, France, Germany, Italy and Sweden. The adults, the habits of which are given in detail, appear from May to August, the males only occurring in the earlier part of this period. The eggs, which hatch in about 9 days, are laid chiefly in the tissue of the stamen sheath. There is one larval moult, and the second stage, when full fed (about 24 days from oviposition), descends into the ground to a depth of from three to twelve inches. Here the mature larva remains till the following spring, when the two pupal stages are passed through and the adult emerges. There is only one brood each year.

The parts of the plant which suffer most from the ravages of this insect are the young leaves in the terminal shoots, the flowers, and the pods; there is no record of the older leaves being attacked. In England, the terminal shoots appear to be infested only when other situations are not available, as in the case of a very early attack in May, before the flowers are out, or later in the year on late sown varieties. When the flowers are attacked, they shrivel up and turn brown, and in cases of severe attack no pod at all may be formed. The damage is generally most noticeable when the pods are small; they are then undersized, deformed and covered with characteristic silvery-brown areas where the larvae have been feeding, due to the presence of air in the outer cell layers of the plant introduced by the sucking action of the larvae. The damage may be very extensive and occasionally the whole crop is spoiled. *K. robustus* seems to confine itself chiefly to the edible pea (*Pisum sativum*) and the broad bean (*Vicia faba*) and their varieties. Both field and garden crops are attacked, but the latter seem to suffer most. This may be due to the fact that in fields there is usually a rotation of crops, while in gardens the same crop is often grown on the same plot, or close to it, year after year. The author has not yet found this species on either sweet peas (*Lathyrus odoratus*) or scarlet runner beans (*Phaseolus vulgaris*), though these are host-plants in France. Thrips are often abundant on both plants, especially the latter, but, in the author's experience, always belong to other species, chiefly *Frankliniella intonosa*, *T. tabaci*, *T. validus*, or *Physothrips atratus*. When damage is recorded on runner beans, it is thought to be due to one or more of these species and not to *K. robustus*. The author has also found this species on flowers of knapweed (*Centaurea nigra*), and it has been taken both in Bohemia and Britain in flowers of *Scabiosa arvensis* [field scabious or clod-weed]. *Medicago sativa*, *Cijuga reptans*, *Ecbalium elaterium*, and *Coronilla vulgaris* have all been recorded as food-plants in France, but the last two do not occur in Britain. A few notes are given of other AEOLOTHRIPIDAE and THRIPIDAE found on peas and beans.

There was great mortality of hibernated larvae of *K. robustus* owing to a fungus which attacked them even in dry conditions. The hyphae radiated out from the attacked larvae, and any others close by soon became infected. The author was able to feed larvae of *Coccinella bipunctata* in captivity on larvae of the pea thrips, but in the wild state he never found these larvae in the infested flowers, and believes that they exert little, if any, controlling influence. Vuillet [see this *Review*, Ser. A, ii, p. 488] has recently described *Thripoctenus brui* as parasitic on *K. robustus* from France, but this Chalcid has not been found in England.

Wet weather always causes great mortality among thrips and also causes the plants to grow more rapidly, but in this species rain has less effect, owing to the sheltered position of the insects in the flowers. The pea thrips is most prevalent on light or gravelly soils, and it is probable that the conditions in a light soil are more suitable for the hibernating larvae. No variety of pea or bean is immune to the attacks of *K. robustus*, but the earlier sown plants usually escape severe damage.

Artificial control of this insect is difficult. Spraying is only of use when the larvae are feeding openly on large pods. Any contact spray (soft soap, resin, etc.) should give good results and on a small scale the following stock solution has been found to be successful: water, 1 qrt.; soft soap, 3 oz.; and tobacco powder, 3 oz.; the whole to be boiled for a short time and diluted for use in about one part to twenty of water. Soil fumigation during the winter should give good results, but must be done to a sufficient depth. Rotation of crops should be practised wherever possible, and peas and beans grown as far as possible from the areas attacked in the previous year. The aldehydes recommended by Howlett [see this *Review*, Ser. A, ii, p. 271] were tried, but were not found to attract this species. The burning of the pea sticks during the winter, which is frequently recommended, is useless. A few notes on the collecting and breeding of thrips are given. A bibliography of 30 references is appended to this article.

Awati (P. R.). **The Apple Sucker, with Notes on the Pear Sucker.**—*Ann. App. Biol., London*, i, nos. 3 & 4, January 1915, pp. 247-272, 2 pls., 21 figs.

This study of *Psylla mali* (apple-sucker) was made at Brentford, Middlesex, during the summer of 1913, but as the life-history of this insect occupies a whole year, no stage repeats itself in one season, and the author was unable to repeat or check his observations.

The eggs are laid singly on the twigs of the apple tree and are distributed irregularly, the new twigs of the first year's growth being chosen by the female. The eggs are found along the scars on the twigs left by the leaf petioles. The egg is described in detail. The larvae generally begin to hatch in the last week of March and may continue to do so until the end of April. The larva crawls towards the apical bud of the twig, and if the bud is not yet opened, it can live without food for two or three days. There are, in all, five instars, the last of which is here called the nymph. Each instar is described and figured and the period occupied by each stage tabulated. A detailed account of the habits of the immature stages is given and

the methods of breeding and collection described. All the instars, except the fifth, are gregarious in habit. Infested buds can be easily recognised by the waxy threads hanging down from them.

P. mali is most dangerous to apple trees in its larval stages; the adults doing practically no damage. The leaves wither and the buds are destroyed wholesale. All remedies should be applied when the insect is in the larval stage. Soon after the flowers are set, *P. mali* is in the adult stage, when it does no damage. The different catches observed, did not indicate any great disproportion in the sexes or any evidence of the existence of parthenogenesis. The change of colour in the adults is described. The presence of *P. mali* in the adult stage can easily be recognised by the minute circular, white spots with which the leaves are marked; these spots are caused by the sucking of the juices and seem to increase in size, and later the damaged surface disintegrates and small holes are formed. The adults are rarely seen on the wing unless disturbed, when they take a short flight from leaf to leaf or twig to twig; they usually occur on the under surface of the leaves. They migrate to other plants near apple trees and are found on gooseberry bushes, pear trees, plums, etc. This may explain how infestation is carried from one orchard to another, as their powers of flight would not suffice for direct migrations from one apple-orchard to another. Both tracheal and reproductive systems are described and figured, and it is suggested that the former organs deserve more attention, as they are the chief medium through which a contact poison acts. The egg-laying season only extends over a week, in the first half of September. The adults are found as late as October and appear to die towards the end of that month. Except for some red mites, no enemies of *P. mali* were observed.

P. pyricola (pear-sucker) is the most important pest of pear trees on the Continent and in America, and has recently been found in the United Kingdom. It has a similar life-history, but there are many important differences which make it more formidable. Anatomical differences are briefly indicated. The larvae of *P. pyricola* are always embedded in the waxy secretion they exude, which wets the surface of the leaf, but there are no white threads, nor are there white spots on the leaves. On this secretion grows the injurious fungus, *Cladosporium herbarium*, the sooty mould. The larvae are always found in the open surfaces of the leaves of the pear trees and suck the juices of the leaves, which become curled and withered. *P. pyricola* is injurious in both larval and adult forms, while *P. mali* is only harmful in the larval stage. There are three generations, the first in April and May; the second, June, July; and the third, August, September. The adults of the third generation pass through the winter and lay eggs in the following spring when the females are fertilised.

Experiments were made to find a fluid which would penetrate the waxy secretion, thoroughly saturate the bud leaves, and so reach the larvae. A solution of 10 lb. soft soap in 100 gallons of water was found to be a satisfactory solvent, but this will only kill the larvae when it dries instantaneously, and in one experiment 28 per cent. were living after one spraying, mainly those on leaves not exposed to the wind and sun. In order to obtain some poison which would facilitate the action of the soap solution, experiments were made with other wax solvents: xylol, petrol, kerosene, acetone

and creosote, of which the last-named proved to be the best. Though these reagents are poisonous to the insects, they also do a great deal of damage to plants, if used in excess. The proper time for spraying is before the floral buds open. If delayed too long, spraying will shake the pollen from the flowers, and in no case should there be any spraying when the blossoms have opened. There is another chance of spraying when the setting season starts and the petals begin to drop off and the fruit becomes set. This final spraying, combined with the previous one, will completely exterminate the insect. Spraying at different times in the day has varying results; the same mixture was sprayed over the apple trees at different times in the same day, but the best results were obtained from the noon spraying, when it was bright, windy and hot.

Three different washes were used: resin wash, paraffin emulsion and soap-creosote emulsion. The composition of the first was resin, 2 lb., washing soda, 2 lb., and water, 20 gallons; that of the paraffin emulsion, paraffin, 2 gallons, bar soap, $\frac{1}{2}$ lb., and water 1 gallon—this being diluted one part to nine of water. The composition of the soap-creosote emulsion, which was found to be the best, was: 100 gallons of water, 10 lb. of soft soap, and 1 qt. of creosote oil (crude commercial); one hundred gallons of this wash only cost 2*s.* 6*d.*

Several experiments were tried with different percentages of the oil, that of the soap solution being constant, from which it seems that creosote oil in the percentage used (·25 per cent.) is not at all harmful to the trees. The percentages and results of these different applications were deduced by spraying one of the heavily infested trees, and then each of the four observers broke twigs at random; these were then spread out on papers, and when dry, the dead and living larvae were picked out. The soap solution, on being mixed with the creosote oil becomes a deadly poison; it enters the tracheae and blocks the stigmata and thus introduces the creosote into the body. There is no chance of recovery for the larvae, as is the case when soap solution is used by itself. The proportion of creosote, however, seems to be fixed—·25 per cent. being the optimum; below or above it the results are not satisfactory.

Cooper (W. F.) & Nuttall (W. H.). **Insecticides from a Chemical Standpoint.**—*Ann. App. Biol., London*, i, nos. 3 & 4, January 1915, pp. 273–279.

This paper is a plea for the application of chemical knowledge to the preparation of insecticides, the formulae for which are but too often purely empirical. It is not enough to know that a given mixture is a useful insecticide, careful experiment is required to determine how it acts and which of the ingredients is the essential one. It has long been popularly supposed that the disinfectant and germicidal value of coal-tar lay in the phenol compounds it contains, but it is now known that some of the non-phenolic constituents have an even greater germicidal value. Something cheap and easily obtained is necessary, but the authors urge that there is still a wide range of substances to be studied which comply with these conditions and that what are now laboratory products may possibly prove to be very efficient insecticides and capable of manufacture at a cheap rate on a large scale

should the demand for them arise. The preparation of "Antinonnin," an ortho-cresol into which two nitro groups have been introduced and prepared on the analogy of benzene nitro compounds which are known to be insecticidal, is cited as an example of the value of systematic research as opposed to empirical methods. Ehrlich's researches on the effect of the position of the arsenic in the molecule led to the production of the famous "606," highly toxic to blood parasites and practically innocuous to the host. There is no great difficulty in preparing a number of excellent insecticides when cost of production is no object. The use of cupric-di-methanal-di-sulphite $Cu\ (H_2C.OH.SO_3)_2$, which is easily prepared by passing SO_2 into a suspension of copper hydroxide in 40 per cent. formalin, has been suggested. A clear blue solution containing 3 per cent. of copper is obtained, and it is claimed that it combines in itself a copper insecticide and a sulphuring agent. The probability exists that many insecticides operate by providing the material for the liberation of minute quantities of a compound in the nascent state and a solution of β naphthol in caustic soda can be so adjusted that a mere trace of CO_2 will precipitate a minute quantity of β naphthol. The value of potassium sulphide probably depends on the slow precipitation of minute particles of sulphur, and solutions yielding exceedingly finely divided sulphur under the influence of mere traces of CO_2 can be prepared. Copper may be combined with paraffin by dissolving copper resinate in mineral oil. If the mere suffocation of an insect by blocking its breathing orifices be desired, it is suggested that "viscose," a derivative of cellulose, might be tried. Great stress is laid on the importance of the physical condition of the remedy used in relation to its efficiency, emulsions generally having a much higher bactericidal power than solutions. The use of an emulsified oil in conjunction with sodium arsenite for tick eradication enabled a much lower strength of arsenite to be used with equal effects and at the same time removed all danger of killing cattle by scalding, a not infrequent accident. In conclusion it is urged that the Entomologist and Chemist should join forces, the former to investigate and discover what is best to be done and the latter to devise the means, so far as possible, under the given conditions.

LEFROY (H. M.). **Insecticides.**—*Ann. App. Biol., London*, i, nos. 3 & 4, January 1915, pp. 280–298.

There is a fashion in insecticides. At one time Paris green and London purple ruled; then came lead arsenate in America; this is apparently giving place to zinc arsenite and barium arsenite, while there is reason to hope that lead arsenate, and perhaps lead chromate, will become more familiar in this country. In America, there was an era of paraffin emulsions and resin washes; then came whale oil soap; lime, salt and sulphur followed; then the heavy oils and then "miscible oils." Lysol and similar mixtures are in use on the Continent and miscible oils are being used more freely in Australia and South Africa. The author quotes the insecticides recommended during 16 consecutive weeks in the *Gardeners' Chronicle* in 1913, the leaflets of the Board of Agriculture and information from general sources, reports, etc., and finds that the following are the methods in fairly general use. (1) Lead arsenate or Paris green for caterpillars.

(2) Soft soap and quassia for hop aphis ; soft soap alone or with quassia extract for aphids generally. (3) Sulphur in some form for red spider. (4) Washes containing free caustic alkali for cleaning tree trunks in winter. (5) Paraffin in very weak emulsion with soft soap or paraffin stirred up in water for garden pests. (6) Lime, salt and sulphur in vague proportions for apple-sucker, etc. (7) Lime washing for winter use. (8) Nicotine as a general panacea for all pests, as a stomach poison for caterpillars, as a contact poison for apple-sucker, aphis, etc.

These are probably all used as the result of tradition and purely empirical practice, with experience on a large scale as the deciding factor. It is pointed out that even the so-called experience is of little value in the case of many-brooded or migrating insects, such as aphids; plums are sprayed in June against the leaf-curling aphis and when, a week later, none are found, the spray has the credit, whereas the aphids have really only migrated. It is not known how paraffin, soft soap or quassia act on the insects against which they are used, and probably much of the good done is more or less accidental and a better and correct knowledge of how and why these substances kill would assist the discovery of better and more certain insecticides. The spreading over and wetting of the plants by the insecticide is generally necessary, and this is practically a question of surface tension and the problem may be stated thus :—When a solid body (the leaf) is in contact with two fluids (air, wash), if the tension of the surface separating the solid from the second fluid (wash) exceed the sum of the tensions of the other two surfaces, the second fluid will gather itself into a drop and the first fluid spread over the surface. If the reverse, the wash spreads over the whole surface and will wet the solid. As to the action on the insect, there are three points to be considered—mere spreading over mechanically, wetting with spreading, toxic action after wetting. In the first case, of which lime-wash is an example, the cause of death is probably suffocation. In the second case, the question is whether the whole insect is wetted or only parts of it, or there may be a film of liquid lying over the whole insect but not actually in contact with it. True wetting should mean that the liquid is at least in contact with the spiracles. In the third case, there is further a toxic action, but when an insecticide spreads, wets and penetrates into the insect, it is not really known what happens. Experiments were made with meal-worms with the following results :—No result is obtained by applying any liquid for a short time to the skin, but many fluids act at once if applied to a single spiracle ; interference with the mechanical functions of at least five pairs of spiracles is necessary to produce any symptoms due solely to mechanical interference ; closing all spiracles produces a condition that may be called "rigor," in which a liquid will enter the spiracles ; it is impossible to cause a liquid to enter one spiracle unless this condition is produced ; dipping a meal-worm into a liquid produces the condition in which the liquid enters. We can therefore compare the effects of liquids by this means. Of liquids tested, the following results were obtained :—Killed all : clove oil, xylol, turpentine, nitro-benzene, chloroform, amyl acetate, cymene, pseudocumine. Killed some : quinoline, carbolic acid, formol 4 per cent., pyridine, acetic acid, eucalyptus oil, methyl salicylate, aniline, acetic ester. Killed none : picric acid in

water, alcohol 70 per cent., nicotine 1 per cent. aq., acetone, ether, chloral hydrate aq., water. The net result of these experiments goes to show that a much greater range of liquids than are generally used have a toxic action, and it is probable that the structure of the spiracles and tracheal system is a far more important factor than is generally supposed. It would almost appear that most insects can only be reached with an insecticide through the spiracles, and that an insecticide which does not actually fill the spiracles is not active. This possibly explains the common failure of contact poisons against large insects. It is suggested that a careful study of the tracheal system of each insect should be made, then of the wetting action of the insecticide on the plant, thirdly of the wetting action on the insect, and fourthly of the suitable toxic ingredient to be added to the insecticide. This offers a large field for what the author regards as very necessary research. What is wanted is a reason for the method adopted, and at present this is often deplorably lacking.

HARGREAVES (E.). **The Life-History and Habits of the Greenhouse White Fly** (*Aleyrodes vaporariorum*, **Westd.**)—*Ann. App. Biol., London*, i, nos. 3 & 4, January 1915, pp. 303-334, 56 figs.

Aleurodes vaporariorum has a wide range of food-plants; it prefers potatoes, and such greenhouse plants as tomato, cucumber, melon, heliotrope, lantana, and salvia. The flies and larvae occur in such immense numbers that the plants become impoverished, and the quantity and quality of such fruit as tomatoes and cucumbers are affected. The whole of the under-side of the leaves is often completely covered with the scale-like larvae and pupae. These produce a large amount of excreta (honeydew), which fall on to the leaves below, encouraging the growth of fungi that ruin plants used for ornamental purposes. The adults prefer the young leaves for oviposition, and gradually ascend as the plant grows; hence there will be all stages of the life-history on different levels of the plant; adults will be emerging on the oldest leaves. Occasionally eggs are laid on the stalks, flowers, and upper leaf-surface, but they are generally laid in circles on the under-side, if the leaves are not very hairy and the insects undisturbed. The mode of oviposition and the changes of colour of the egg, which generally hatches from 10 to 13 days after deposition, are described, as well as the mechanism of hatching. The greater part of this paper deals in great detail with all stages of the life-history. The first instar lasts about 11 days, the second about 18, the third instar, which is also inactive, varied from 5 to 36 days. The pupal stage (fourth instar) varied in duration from 21 to 59 days. The longest duration of the fifth (imago) instar was 38 days.

The author placed three females, isolated before complete emergence so as to be certain that they had not been fertilised, each on a clean plant. From these he obtained ten, thirteen and twenty imagines, respectively, all females. From these he got females again, and of the hundreds of flies examined did not encounter a single male. Morrill, writing on parthenogenesis in the ALEURODIDAE, states that unfertilised eggs hatch, giving larvae resulting in male flies, and suggests that the fertilised eggs will all give rise to females, as in bees. Morrill and Back further established parthenogenesis in *Aleurodes citri*.

The author did not encounter any animal parasites of *A. vaporariorum*, either of the nymphs or the adult, though they seem to be occasionally devoured by spiders and mites. Fungi sometimes kill both adults and nymphs. The transparency of the larvae is probably a factor in eluding predaceous enemies, as it renders them practically invisible; the adults escape by dropping and flight.

A bibliography of nine references (1856–1913) is appended.

Lees (A. H.) **Winter Cover Washes.**—*Ann. App. Biol., London*, i, nos. 3 & 4, January 1915, pp. 351–364.

Winter cover-washes, or more properly late spring cover-washes, were first tried on a large scale by Mr. Howard Chapman of Kent. He found by experience that a lime-wash, applied as late as possible before the buds burst in spring, produced a very decided lessening of *Psylla* attack and consequent increase of crop. Cover-washes have also other subsidiary, but very real, advantages: (1) They can be applied when labour is easily obtainable, while a summer wash has to be put on at the end of April, nearly two months later, when labour is urgently needed for other operations; (2) they tend to keep the bark clean; (3) they add a small amount of lime or chalk to the soil. The two hypotheses as to the action of the wash on the insects are, that it is directly destructive owing to its causticity, or that it acts as a seal and prevents hatching. The former is untenable, as the causticity is far too feeble to have any chemical action on the chitin of the eggs worth considering. The second is more probable, and it is apparent that to make such a wash most efficient certain conditions must be fulfilled—viz., it must give a thick covering; it must resist all external conditions causing lessening of the coat when once on the tree, *i.e.*, it should not flake when dry or wash away when wetted by rain; it should be applied as late in the spring as possible; the materials should be reasonably cheap and easy to obtain and mix. A number of field and laboratory experiments were made with various materials calculated to give the required results. A most important matter is the thorough slaking of the lime; a 40-gallon barrel of lime-wash made in the evening will be warm the next morning, and unless the hydration be completed before application, it continues on the tree and the wash flakes and cracks off. It seems to be best for use when about 48 hours old. The experiments were undertaken to find a cover-spray which is thicker than ordinary lime-wash, resists weather conditions and is cheap and easily made. Of these, a formula containing whiting, glue, starch, potassium dichromate and water fulfils the first two conditions, but its cost works out at 2*d*. a gallon, and it is not sufficiently easy to make, as so much hot water is required. If lime alone is used it must be used when fresh, and should be allowed, if possible, to stand for 12 hours before application. To do this on a large scale one-third of the total quantity of water may be added first. When it is to be applied, the other two-thirds may be added. This does away with the necessity of having a large number of tubs. The beneficial action of lime-wash on *Psylla* eggs is due to the mechanical, sealing action rather than to any chemical effect.

HORNE (A. S.) & LEFROY (H. M.). **Effects produced by Sucking Insects and Red Spider upon Potato Foliage.**—*Ann. App. Biol., London*, i, no. 3 & 4, January 1915, pp. 370-386, 4 plates.

This paper details a series of experiments undertaken to ascertain accurately what effects are produced in potato foliage by the action of sucking insects. The following species were used in making infestations: *Aleurodes vaporariorum*, Westw., *Tetranychus telarius*, L. (red spider), *Rhopalosiphum solani*, Theo., the two Jassids, *Eupteryx atropunctata*, Goeze, and *Chlorita viridula*, Fall. (? *C. solani*, Koll.), and the Capsids, *Calocoris bipunctatus*, F., and *Lygus pabulinus*, L.

Definite and similar symptoms, apart from any other cause, were obtained as the result of infesting young plants raised from seed of the "President" variety of potato with the above insects under various experimental conditions as follows: *T. telarius*, leaves become mottled, plants turn brown and die; *A. vaporariorum*, effect gradual, plants weakened, but did not die; *R. solani*, leaves with discoloured veins, brown and dead leaf-ends, yellowing and death of the plant; Jassids, white spots, plants did not die; Capsids, dark brown blotches on leaves and young growth, veins darken, young leaves and shoots killed rapidly.

These symptoms did not develop in the controls, except where the control plant became infested by the particular insect in the experiment.

The effect on the foliage tissue in each case is as follows: *T. telarius*, epidermal and sub-epidermal cells injured; *Aleurodes*, conducting tissue tapped, not followed by vein discolouration; *R. solani*, conducting tissue tapped, followed by vein discolouration after nine or ten days; Jassids, epidermis punctured, assimilatory tissue destroyed; Capsids, tissue lacerated, causing severance of veins and leaving ragged, irregular pits which rapidly become discoloured, as do also the veins within two days.

The markings caused by Jassids and Capsids proved distinctive and could be recognised as such, for some time after the injury, but for the safe recognition of Aphid (*R. solani*) injuries, the association of typical markings with Aphids or their remains is necessary. Evidence was obtained that *Aleurodes* selects particular plants. Definite symptoms due to Aphids, Jassids and Capsids, correlated with the presence of remains of these insects, have been found in the field crops in several districts in three consecutive seasons. During and after periods of wet weather, the original injuries, especially those caused by Aphids and Capsids, frequently suffer secondary extension, and the foliage is prematurely destroyed. From field observations, Aphids appear to exhibit a preference for certain varieties or races of potato, but the question of selection has not been experimentally studied by the authors.

PETHERBRIDGE (F. R.). *Exomias pellucidus* as a plant pest.—*Ann. App. Biol., London*, i, nos. 3 & 4, pp. 390-392, 1 plan.

On 14th May 1914, an enquiry was received from a nursery at Fordham, Cambs., concerning the damage done to a number of plants by the weevil *Exomias* (*Barypeithes*) *pellucidus*. A visit was

paid to the nursery on 16th May and the weevils were found there in enormous numbers. Thousand-heads, kohl-rabis, poppies and *Nemophylla* were all eaten off so that the ground was bare. *Collinsia bicolor* and candytuft were badly damaged and were only saved by a heavy application of lime and soot. *Gypsophila elegans* escaped, although situated in the middle of the area attacked. A few weevils were found feeding on the leaves of ornamental maples. Potatoes, peas and spruces were free from attack. Near the attacked area, large numbers of the insect were found under the spruces and also sheltering in rabbit burrows. Leaves of cabbage and rhubarb placed on the ground were found in a few hours to be entirely covered with the insects on the lower surface.

The insects usually feed on the lower surface of the leaves, at least in the sunlight. Many young plants were eaten off just above the ground level, *i.e.*, through the portion of the stem below the seed leaves.

The damage was first noticed on 13th May, and on 14th May 75 bushels of soot was spread over the attacked area, measuring about two acres. This was followed by the application of 30 bushels of lime on 15th May. On 16th May a large number of the beetles were found dead. On 17th June large numbers of dead beetles were present over the attacked area and only an occasional living one was found.

GOWDEY (C. C.). **Notes on a Scale-Insect attacking Cacao in Uganda.** *Ann. App. Biol., London*, i, nos. 3 & 4, January 1915, pp. 399–402. 1 fig.

Stictococcus dimorphus, Newst., has been collected in Uganda on mulberry, *Markhamia platycalyx*, ornamental *Hibiscus*, *Anona muricata*, *Croton tiglium*, guava and *Cajanus indicus*, as well as on cacao. With the exception of *M. platycalyx*, all these plants have been introduced. As this Coccid has been found in the depths of a forest of 180 square miles, on *M. platycalyx*, it is clear that it is an indigenous species. Cacao appears to be the favourite food-plant. When the varieties, *Theobroma cacao*, var. *foresteiro* and var. *creollo* are grown side by side, the infestation on the former is invariably the more serious. The insects are always restricted to the pods and stems of the pods, and never occur on the foliage or branches of cacao.

This scale-insect is not readily killed by insecticides at the usual strengths; but, fortunately, as it is always found on the pods, insecticides may be used at greater strengths than they could be applied to the foliage in Uganda, where the trees are never dormant and where for some reason, probably the altitude, oils used at the usual strengths are most apt to scorch the foliage. The results of some experiments with a large number of contact poisons are tabulated. As a result of these, the author recommends the use of whale-oil soap (1 lb. to 4 gallons of water) and soft soap-kerosene emulsion, made by boiling together 8 lb. soft soap and 5 gallons of kerosene; on cooling, this becomes a jelly, 10 lb. of which is added to 30 gallons of water for use. The average percentage of scales found killed in three examinations, was 94·8 for the former insecticide, and 93·8 for the soft soap-kerosene wash.

The author has frequently bred the Noctuid moth, *Eublemma costimacula*, Saalm. (ERASTRIINAE) from *S. dimorphus*. Other Uganda representatives of the genus *Stictococcus* are *formicarius*, Newst., and *gowdeyi*, Newst.; the former attacks *Ficus* sp., and the latter *Harrogania madagascarensis* and coffee.

[The Uganda and West African representatives of *Stictococcus dimorphus* have recently been separated specifically by Prof. Silvestri from the typical East African form under the name of *S. diversiseta*, Silv.—ED.]

TRYON (H.). **Onion white blast.**—*Queensland Agric. Jl., Brisbane,* iii, no. 1, January 1915, pp. 27–28.

The so-called blight or "white blast" affecting the onion crop in the Memerambi district is due to an, as yet, undetermined species of thrips. The use of a nicotine spray is advised: 1 lb. of tobacco in 2 gallons of water diluted to 4 gallons, adding a little soap or molasses to promote adhesion. Sprays containing white oil soap and kerosene emulsion have been advocated and may be used, but both are liable to do injury, especially if not well made or if applied when the light is strong.

JARVIS (E.). **Beetle borers of sugar-cane.**—*Queensland Agric. Jl., Brisbane,* iii, no. 1, January 1915, pp. 32–33.

Cryptorrhynchus sp. and *Rhabdocnemis* sp. have been found at Macnade in two varieties of sugar-cane. The injury done by the former is somewhat similar to that caused by *Rhabdocnemis obscurus*, but the tunnels seldom exceed 4 inches in length, are very irregular in width, and may entirely encompass an affected internode, thus destroying most of the internal portion. The larva does not construct a cocoon, but pupates at the end of its tunnel in an egg-shaped chamber, one end of which consists of débris tightly compacted, the whole interior being smoothed and rounded. The other weevil inflicts injury very similar to that caused by *R. obscurus*.

EHRHORN (E. M.). **Division of Entomology.**—*Hawaiian Forester and Agric., Honolulu,* xii, no. 1, January 1915, pp. 13–16.

During November 1914, the pests intercepted were: *Balaninus* sp. (chestnut weevil), infesting a package of chestnuts from Kentucky, and *Bruchus* sp., in forest seeds from Ceylon; both packages were fumigated with carbon bisulphide before delivery. Two large boxes of ornamental plants arrived from Japan and were fumigated and all soil removed from the roots of the plants. In this soil were found the larvae and pupae of a small weevil said to be injurious to pot plants in Japan; some larvae of an *Anomala* beetle were found, also one larva of *Serica japonica*, all these being injurious to the roots of various plants. During the month, 15,775 parasites were liberated. For fruit fly, (*Ceratitis capitata*): 1,250 *Opius humilis*, 700 *Galesus silvestrii*, and 1,050 *Tetrastichus giffardi*. For horn-fly, stable-fly and house-fly: 5,500 Philippine *Spalangia*, 2,600 *Muscidifurax vorax*, 4,000 Philippine Pteromalids and 675 *Dirhinus giffardii*.

Appended is a report by D. T. Fullaway who during November 1914 amongst other parasites bred 2,450 *Tetrastichus giffardi* from 1,967 pupae.

TROOP (J.). **Report of the Entomological Department.**—*Twenty-seventh Ann. Rept. for the year ending 30th June 1914, Purdue Univ. Agric. Expt. Sta., Lafayette, Ind.*, January 1915, pp. 48–49. [Received 1st March 1915.]

Studies of the life-history of *Cydia pomonella* are being continued with a view to determining the most suitable number of spray applications. This insect appears to be changing its working habits. The Hessian fly, *Mayetiola destructor*, has been very destructive, and in some places the wheat crop was practically ruined by it. This is usually due to lack of general knowledge concerning this pest, and suitable bulletins were sent out. The army worm, *Cirphis unipuncta*, did considerable damage to growing crops in various sections before it could be checked. The chinch bug, *Blissus leucopterus*, was very destructive in some of the counties. The damage done by this species is estimated at from $50,000,000 to $75,000,000 per annum in the United States, while the figure of $100,000,000 may be reached in years of great prevalence. The clover leaf-beetle did more damage during 1914 than for many years, especially on young lucerne fields. Several species of leaf-hoppers and many other insects have been found on lucerne. By sweeping the young lucerne with a net, as many as 25 different species were caught.

TRÄGÅRDH (Ivar). **Bidrag till kännedomen on tallens och granens fiemder bland smafjärilarne.** [Contributions towards the knowledge of the injurious Microlepidoptera of the fir and spruce.]—*Skogsvårdsföreningens Tidskrift, Stockholm*, 1915, 60 pp., 49 text figs.

Dioryctria schutzeella, Fuchs., described from Saxony in 1899, was found in the middle of June on spruce in the vicinity of Stockholm. The moth appears in the middle of July. The larva is red-brown with a black head, yellow prothoracic and anal shield and two darker longitudinal streaks. It attacks the needles of the young shoots. *Tortrix* (*Pandemis*) *ribeana*, Hb., is said to be a very polyphagous species, but has previously been recorded only once from the spruce, by Wachtl. The full-grown larvae were observed in the middle of June on young spruces at the Experimental Station. They attack the young shoots generally on one side and devour the needles and often damage the bark also, so that the shoots become deformed. Generally, the shoots on the side branches are attacked, but even terminal shoots are occasionally injured. The larva is green, with lighter coloured ventral side and lighter hair spots. The head is yellow with darker patches, and the prothoracic shield has also dark markings.

Eucosma (*Grapholitha, Epiblema*) *tedella*, Cl. In 1867, Holmgren considered this species to be one of the most dangerous microlepidopterous pests of the spruce, but subsequent information has not supported his view, injury caused by this moth having been recorded only once, in 1891, at Badsbo. It is therefore suggested that this moth was held responsible for injuries caused by other unidentified species. In the vicinity of Stockholm the moth appears at midsummer, and in the middle of August single mined needles can be observed. In 1914, they were noticed as late as November. The mined needles

do not change colour in the same autumn and do not drop, consequently the injury is not very apparent at that time. Subsequently, the needles turn yellow, but generally remain in the webs spun by the larvae and form the so-called nests. The larva measures 9 mm. in length, and is easily recognised by the two light red paradorsal bands. The colour is light green, with the head, the prothoracic and anal shield and the legs brown. All the hairs are surrounded by small dark spots. The injury caused by *Enarmonia* (*Grapholitha*, *Epinotia*) *nanana*, Tr., is exactly similar to that caused by *E. tedella*, but it occurs in the spring, and on this account it is much more dangerous. Mined needles were observed in the middle of May in small numbers, and from this it is concluded that the eggs hibernate. The larva is pale, dirty yellowish and 8 mm. long, with a black head, brown prothoracic shield and yellow anal shield. It has no paradorsal bands nor spots around the hairs, and is therefore easily distinguished from the larva of *E. tedella*. In 1913, this species damaged spruce in the vicinity of Kve Lake in Norway and at Frostviken in Sweden. Many trees were completely defoliated, but in spite of this, the buds developed quite normally. *Argyresthia illuminatella*, Zell., has not been investigated since 1830, when Saxesen studied it, the results appearing in Ratzeburg's work on forest insects. Damaged buds of spruce were observed in May in the vicinity of Stockholm. The buds were hollowed out and filled with excrement, and in the terminal bud the pupa was discovered lying with the head pointing towards the base of the shoot. Generally, the needles in the terminal part of the shoot had dropped. The moth emerged in the latter half of June. The damage caused by this moth differs considerably according to the age of the tree. On young trees, 20–40 years old, only the terminal shoot is destroyed, but on the buds of the lower branches of older trees a part of the axis is also hollowed out, the length of the destroyed part depending on the size of the buds, which proves that the larva attacks the buds first and subsequently the axis in case of need. On the terminal shoots of younger trees the axis is not injured, but a narrow winding gallery is always noticed in the bast. At the end of the gallery in the axis there is a circular hole, made by the larva before returning to the terminal bud in order to pupate ; through this hole the moth emerges, the pupa case remaining in the bud. The moth has not previously been recorded from Sweden, but is undoubtedly common there, damage having been recorded in 1914, both from the north of Jämtland and from Vesterbotten. The larva of *Tortrix* (*Cacoecia*) *piceana*, L., at first attacks the single pine needles much in the manner of a *Coleophora*, but soon spins two needles together and attacks them from the interior of the tube thus formed. It hibernates in a tube made of six or eight needles. In 1914, the larva was observed feeding as late as the 20th of October. The following spring it attacks the needles and spins them together with the young shoots, which are often injured. At the end of May pupation takes place, and the moth appears in the middle of June. The young larvae of *Rhyacionia* (*Evetria*) *resinella*, L., attack the needles, entering through a hole at the base of the shoot and devouring the base of the needles more or less completely. The needles turn yellow, and it is thus very easy to recognise the presence of the larvae early, before they have started making galls.

Exoteleia (*Heringia*) *dodecella*, L.* The moths appear in June, and the young larvae mine in the terminal part of the pine needles and hibernate in a needle, after having spun over the hole and clothed the mine with silk. At the end of April or the beginning of May, the larvae leave their hibernating quarters, having previously fed on the remainder of the needle, and attack the young shoots. They spin a silken tube between the base of the needles, which soon becomes quite white, being encrusted with resin. By this tube it is easy to recognise at once the attack of this species. It was previously only recorded from Scania, Småland and Gothland, but is undoubtedly widely spread in Sweden, the author having found it wherever he has had any opportunity of looking for it, for example, in the vicinity of Stockholm, the archipelago of Stockholm and Mälaren, as well as in Dalarne. On young pines at Sandham, as many as 50 per cent. of the shoots were often destroyed. *Cedestis gysselinella*, Dup., mines in the pine needles from the base towards the top. The mine is 30–35 mm. long and one needle suffices for one larva, which leaves the needle at the beginning of June, pupae being found in a loose cocoon between the needles in the middle of June, and the moths emerging at the end of June and the beginning of July. There is only one generation a year. The larvae of *Dyscedestis farinatella*, Dup., and of *Ocnerostoma piniariella*, Zell., also mine in the pine needles, but the eggs are laid near the top of them and the larvae mine towards the base. The mines are quite similar, but the method of pupation is different, *Ocnerostoma* spinning together a couple of needles to form a narrow tube, whereas *Dyscedestis* is said to descend to the ground in order to pupate and spins a double cocoon. The author has been unable to ascertain where pupation takes place, but the cocoon, spun in captivity, was of the shape previously described by v. Nolcken. There are two generations a year, probably in both species. The larvae do not lie dormant during hibernation, but were observed to feed in the beginning of February, at Karlsborg, when the temperature was about 42° F.

The larvae of all species and the pupae of most of them are minutely described and figured.

Trabut (L.). **Pour économiser le cuivre.** [A method of saving copper.] —*Bull. Agric. Algér. Tun. Maroc.*, *Algiers*, xxi, no. 1, January 1915, pp. 4–6.

It has been believed that Bordeaux mixtures containing less than 1 per cent. of copper sulphate are inefficient. S. Martini, however, recommends a formula used by him since 1895, which is extensively adopted in Tuscany and Piedmont and is based on the addition of alum to a Bordeaux mixture containing 0·4 per cent. of copper sulphate. The formula is as follows, parts being by weight: copper sulphate 4 parts, alum 4 parts, lime 5 parts, water 1,000 parts. Owing to the present scarcity of copper, it appears more prudent to weaken the spray rather than reduce the number of applications. The " Martini

* Mr. J. H. Durrant informs us that the generic name *Heringia*, Splr. (1910), cannot stand, as the type. *H. dodecella*, is also the type of *Exoteleia*, Wlgn. (1881). Unfortunately Spuler has proposed a number of new genera for which older generic names are available.—Ed.

spray" may be used in conjunction with Vermorel's colloidal-soap spray. To prepare the latter, dissolve 1 part of copper sulphate in 250 parts of water ; dissolve 1 part of white, alkali-free, olein soap in 250 parts of water ; finally pour the copper solution into the soap solution, contrary to the usual procedure. An opaque, green or greeny blue liquid is obtained, which wets the grapes effectively. The above two formulae are given with reference to the control of mildew.

CARLE (G.). **La Lutte contre les Sauterelles.** [Control measures against Grasshoppers.]—*Bull. Econ., de Madagascar et Dépendances, Tananarive,* nos. 3–4, January 1915, pp. 243–246.

The collection of information relating to control measures against grasshoppers, which have been tried in Madagascar, has been undertaken by the Colonisation Department and is partly published here. Various methods have been tried : burning, collecting, crushing, burying in trenches and poisoning. Poisoning has been tried in two districts, Ambanja and Ambilobe, the work having been started at the beginning of December and being still in progress. In Ambanja, the workers are satisfied that the poison does not instantly kill the insects, but 24 hours later the swarm was completely poisoned. In Ambilobe, 50–70 per cent. of the swarms operated on were poisoned, though it is noted that the effect of the poisoning was not observed 24 hours after the operation. It is considered advisable to return to mixtures of arsenicals with sugar solution or molasses ; if sugar is not added, the grasshopper eats the moistened vegetation only when driven by hunger. Among other methods, a mixture consisting of 1 part petroleum to 10 parts water is said to have been successful. This method should be further tested, though necessarily costly, 22 gallons costing 6*s*., as compared with 1*s*. 7½*d*. for sodium arsenite. It is suggested that the neighbourhood of Antananarivo affords a good place for experimentation with *Coccobacillus acridiorum.* It is considered that the trench method, especially where labour is plentiful, is the simplest and the most likely to be generally adopted, while poisoning is advisable in sparsely populated regions. It is, however, emphasised that far more important than the choice of a method is a comprehensive organisation for the encouragement and reward of all who detect and inform the authorities of the presence of eggs or of swarms, and suggestions for this purpose are made.

CAESAR (L.) & SPENCER (G. J.). **Cherry Fruit-Flies.** *Ontario Dept. Agric. Toronto, Ont.,* Bull. no. 227, January 1915, 30 pp., 18 figs.

Rhagoletis cingulata, Lw., and *R. fausta,* O. S., have been causing much loss to cherry-growers in Ontario. They were not recognised as pests until 1910 and 1912 respectively. The flies lay their eggs just beneath the skin of the cherry and, on hatching, the larvae feed on the juice and destroy the pulp. In infested orchards, the percentage of wormy fruit varies from 5 to 99. Infested fruits are subject to brown rot and help to spread this disease. It is often almost impossible to tell whether a cherry is infested or not until it is opened. So far, the cherry is the only orchard fruit known to be subject to attack ;

varieties like Early Richmond and early sweet cherries are almost exempt from injury, but all later sour and sweet cherries are infested, especially Montmorency and Morello. Owing to the presence of white cross-bands on its abdomen it is proposed to call *R. cingulata* the white-banded cherry-fruit fly, and *R. fausta* the black-bodied cherry fruit-fly on account of its entirely black abdomen. The flies of the latter species appear on the trees about a week earlier than those of the former, which are usually seen in Niagara about 11th June. They probably live for about three weeks on an average. *R. fausta* disappears from the orchard about two weeks before the white-banded species. Oviposition takes place 10 or 12 days after emergence and in the meantime the flies feed on the surfaces of the leaves and on the juice of injured cherries when these become ripe. The eggs hatch in about 5 days and the larvae attain full growth in about 14 days. On leaving the fruit, they pupate in the soil about an inch below the surface. In this form they remain dormant until the next June, when the adults emerge. Cultivation of orchards does not help to control the insects, but if the soil beneath the trees has a hard surface the emergence of the adults from the soil is interfered with. Ants and birds, including poultry, devour the recently emerged adults on the ground, also the larvae and pupae. Spraying experiments in 1913 and 1914 show that the pests may be controlled by poisoning the adults prior to oviposition. The best formula is 3 lb. of lead arsenate paste to 40 U.S. gallons ($33\frac{1}{4}$ Impl.) of water, sweetened with about 1 gallon of cheap molasses (black strap). Almost as good results are probable if the molasses is omitted. Until the pest is nearly annihilated, two applications should be given each year in badly infested orchards, the first about 8th June, or about a week before Early Richmonds begin to ripen, the second about 20th June, or about the time when the Montmorencies are showing the first symptoms of the red blush. It is well to spray plum, apple and pear trees that happen to be among, or very close to the cherry trees, as the flies rest and feed on their foliage also. Early varieties of cherries should not be given the second application, as they are then too near picking time. Two years' treatment should free an orchard of the pest, unless fresh infestation comes from outside sources. To prevent the rain from quickly washing off all the spray, it should be applied on both surfaces of the leaves. All, or nearly all the foliage should be covered, but it should not drip. The total cost of spraying fourteen-year-old trees twice, should not be more than $2\frac{1}{2}$*d.* per tree. Useless cherry trees at the fence corners or on the road-side should be removed. Adjoining orchards should be sprayed in order to prevent re-infestation. Bees are not attracted to the poison and there is no danger to them, if the directions given above are followed.

REDDICK (D.) & CROSBY (C.). **Further experiments in the dusting and spraying of apples.**—*Cornell Univ. Agric. Expt. Sta., Ithaca, N.Y.*, Bull. no. 354, January 1915, pp. 51–96, 16 figs.

The work reported in this paper is a direct continuation of that done by Dr. Blodgett [see this *Review*, Ser. A, ii, p. 190]. The experiments hinged on six undetermined points and supplied the following information with regard to them :—The dust method seems to be particularly applicable to large old trees, with which the difficulty

in thorough spraying is most apparent. So far as apple scab is concerned, the work of 1914 produced results approximating to those obtained in 1913. Dust mixtures, containing 10 per cent. of lead arsenate, appear to be as effective as those containing twice that quantity [see this *Review*, Ser. A, ii, p. 709]. The quantity of sulphur applied per tree may be reduced without reducing the fungicidal value. No satisfactory information was gained as to whether the addition of an inert substance would improve the adhesive properties of the dry mixture. Paste sulphur, although applied very cheaply, does not seem to be the equal of lime-sulphur solution, though the test cannot be regarded as conclusive.

HIGH (M. M.). **Cactus solution as an adhesive in arsenical sprays for insects.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 160, 22nd January 1915, 20 pp.

Opuntia lindheimeri, Engelm., the prickly pear, is very mucilaginous and is invariably used by Mexicans in the manufacture of whitewash to promote adhesiveness. This suggested its use in preparing arsenical sprays against *Diabrotica balteata*, Lec. (the belted cucumber beetle). It is applicable for the treatment of insects of related habits, such as the striped and twelve-spotted cucumber beetles. Spineless cactus may be used, but the spiny variety appears to be nearly one-third richer in mucilage. If sliced at right angles to the spines, the cactus yields a higher percentage of mucilaginous matter and the time required for preparation is materially shortened. Large pieces are, however, best cut both ways, as this insures a more rapid and copious flow of the juices. The sliced cactus is placed in water in the evening previous to spraying, and the following morning the solid particles are removed before the poison is added. The use of the regular "pear burner," or torch, which singes the spines, enables the cactus to be handled with ease; only a short time is required to burn the spines from enough cactus to make sufficient adhesive material for several thousands of gallons of spray mixture. Cactus growing in low wet places yields less glutinous matter than that from high dry soil. The insecticides that have been employed in combination with cactus include lead chromate, Paris green, zinc arsenite (in both powder and paste forms), lead arsenate (paste), ferrous arsenate, and iron arsenite. With the exception of lead chromate, all these have been the subject of experiments described in this paper. The powdered zinc arsenite gave excellent results in every instance when used in combination with cactus water, and the mortality was in some cases higher than when three times the weight in paste form was used. Very favourable results were obtained with ferrous arsenate in most cases, while the results with iron arsenite were not quite so good. Iron arsenite has little insecticidal value unless an effort is made to apply it in uniform coating to the foliage. A comparison of whale-oil soap and cactus was instituted in order to test their respective value as adhesives, without considering their cost. Thirty-five pounds of sliced cactus was placed in 60 U.S. gallons (50 Impl.) of water in the evening and had given up its glutinous matter by the following morning, when 1 lb. of zinc arsenite powder was added. One acre of cabbage was then sprayed with this mixture, which spread and adhered exceedingly

well. The next acre was sprayed with the same poison, but whale-oil soap was substituted for cactus at the rate of 3 lb. of soap to 60 U.S. gallons. The sprayed plants were observed with and without a lens, and it was found that the soap equalled the cactus in spreading power, but was inferior in adhesiveness. The cactus spray adhered and dried on the foliage better than the soap spray. This is an advantage, since heavy dews will soon wash away poison having but slight adhesive qualities. Copper sulphate, salicylic acid, and sodium benzoate have been employed as preservatives for the cactus solution. The latter kept perfectly for 4 weeks (when the experiment was discontinued) when preserved with copper sulphate. Another trial was made in order to test the possibility of a chemical reaction upon the addition of the arsenical to the solution. Upon the addition of powdered zinc arsenite at the rate of 1 lb. to 60 U.S. gals. of water, a slight chemical reaction was noticed. The slight precipitate formed was not enough, however, to cause any trouble when a good pressure was maintained in the tank of the sprayer. No difference was observed in the effectiveness of the arsenical. Lead arsenate always precipitated when added to cactus solution, but if the latter is preserved as above, the precipitation is so much retarded that spraying becomes possible at a normal pressure with a hand pump. The above combination may be used on a large scale only if a strong pressure can be maintained throughout the operation. Ferrous arsenate was not altered in insecticidal value when mixed with copper sulphate. Both salicylic acid and sodium benzoate were efficient preservatives of cactus solution. By the use of cactus as an adhesive, not only do the arsenicals give better and more lasting results, but considerable expense may be saved, as the freight often costs more than the insecticide itself. Paste arsenicals have been extensively used by fruit and truck growers on account of their better adherence and lasting qualities. The better results which have been obtained by using 1 lb. of powdered zinc arsenite with cactus instead of 3 lb. of paste zinc arsenite to the same amount of water show that equal results may be obtained with a great reduction of freight charges. The quantity of cactus necessary varies with the environment in which the plants have been growing. In general, the correct proportion will range from 5 oz. to 1 lb. to every gallon of water used in making up the spray mixture. Increased adhesiveness is not very apparent at higher strengths, and difficulty may be experienced in application, particularly where very fine nozzles are employed. Three varieties of cactus commonly found in Texas are *Opuntia lindheimeri*, Engelm., *O. engelmannii*, Salm., and *O. tuna*, Will. A chemical analysis of each of these three species is tabulated in this paper.

WEBSTER (F. M.). **The grasshopper problem and alfalfa culture.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 637, 25th January 1915, 10 pp., 8 figs.

Lucerne, to a greater extent than other crops, provides the two conditions which grasshoppers require in order to breed freely and in destructive numbers, *i.e.*, an undisturbed soil for the protection of the eggs, and an early food supply for the young in spring. From the beginning of lucerne culture, the farmer, especially in the West,

has been seriously troubled by these pests. During 1913, serious and widespread injuries occurred in New Mexico, Kansas, Oklahoma, New Hampshire, and Vermont, with lesser outbreaks in Arizona, Texas, Mississipi, Wisconsin, Michigan, and Wyoming. Unless control measures are adopted, the injury will probably spread as the area under lucerne increases. Of the many species of grasshoppers which injure lucerne, the three chiefly concerned are, *Melanoplus differentialis*, Thos. (the differential grasshopper), *M. bivittatus*, Say (the two-striped grasshopper), and *M. atlantis*, Riley. The measures advocated in this paper may be applied in the clover fields of the eastern section of the country with equally good results. The three species here discussed are at times destructively abundant in the red-clover fields of the East and Middle West, and the author has there used the "hopperdozer" to advantage. *M. differentialis* rarely becomes destructively abundant east of the Mississippi River. It is very decidedly so to the west of the Mississippi. *M. bivittatus* is sometimes disastrously abundant as far east as Ohio and, in the red-clover-growing sections of the country, is probably very much the more destructive of the two, though even as far east as Indiana, *M. differentialis* does considerable injury to fruit trees by gnawing the bark from the twigs. Upwards of 100 species of birds are known to feed to a greater or less extent upon grasshoppers, but probably the most useful are quails, prairie chickens, the sparrow-hawk and Swainson's hawk, the loggerhead shrike, all cuckoos, the cowbird, all blackbirds and meadowlarks, the cat-bird, and the red-headed woodpecker. Domestic fowls and skunks are very fond of these Orthoptera, while toads and probably some of the snakes eat them. Of insect enemies, the grasshopper mite is often found infesting grasshoppers in great numbers, but it is possible that its value to the farmer has been over-estimated. The parasitic flies, *Sarcophaga kellyi*, Ald., *S. cimbicis*, Towns., *S. hunteri*, Hough, and *S. georgina*, Wied., sometimes destroy these insects in myriads. Two or three vegetable parasites also do great execution, one of them, *Sporotrichum globuliferum*, being the same as that which attacks the chinch bug. Preventive and remedial measures are, however, absolutely necessary; only those practical in application and cheaply and readily obtainable by the farmer are mentioned here. Except, perhaps, the destruction of the young as they are hatching, the destruction of the eggs seems to be the only preventive measure that promises to be worth while attempting. All roadsides, ditch banks, margins of cultivated and uncultivated fields, grassy margins along fences, and all other waste lands that it is possible to reach and that are thought to harbour eggs, should be cultivated in the autumn or winter. The soil need not be stirred deeply, 2 inches being a sufficient depth to accomplish the desired effect. Put into operation at the proper time, this measure will undoubtedly prevent disastrous outbreaks in the following spring. Concerted action is very desirable. If close watch is kept to determine just when the young grasshoppers are hatching, they may be killed by flooding, in cases where fields can be quickly inundated and the water promptly run off, as is frequently done in rice fields. Flooding is useless once the young have begun to move about. Poisoned baits and the use of a "hopperdozer" should be resorted to when the insects are threatening the lucerne fields. A "hopperdozer" which has been made for the author and has proved

efficient in collecting grasshoppers of all ages, is constructed of sheet iron, preferably galvanized, of reasonable thickness to ensure strength, and, except for the end pieces, made of a single sheet 10 to 12 feet long and 26 inches in width. The front is formed by turning up one edge a couple of inches, and the back may be turned up a foot, thus making a shallow pan 1 foot wide, with a back of the same height and with a front 2 inches high. Ends are rivetted in or soldered. Runners of old waggon tyre are placed at each end and one in the centre. This latter is turned over at the front (low) and back (high) edges of the pan in order to strengthen it at these points. The two side runners should extend both backward and forward in order to overcome to some extent, the inequalities of the ground and cause the machine to run more smoothly. All three runners should be rivetted to the pan and soldering around the heads of the rivets will make it water-tight. The pan is filled with water, on which is poured emough kerosene to cover it with a film, a horse is harnessed to the end runners, and the outfit is then ready for use. By using longer, wider, and heavier sheet iron a larger and stronger pan can be made and this further strengthened by additional runners; a horse can then be used at each end, or the pan may be mounted on low wheels. Poisoned baits may be used even when the insects breed in the lucerne fields. The "Criddle mixture" [see this *Review*, Ser. A, i, p. 453] is very efficient. Another effective formula consists of:—Wheat bran, 25 lb., Paris green, 1 lb., cheap molasses or syrup, 2 U.S. quarts ($1\frac{2}{3}$ Impl.), oranges or lemons, 3 fruits. The bran and Paris green should be thoroughly mixed together. The juices, finely chopped skin and pulp of the fruit are added to the molasses, which is then diluted with 2 U.S. gals. ($1\frac{2}{3}$ Impl.) of water. These should be mixed together and enough water added to bring the whole to a stiff dough. This quantity is sufficient to treat from 5 to 10 acres when properly applied. The fruit is the attractive part of this bait, and its omission will result in a loss of 75 per cent. efficiency [see this *Review*, Ser. A, ii, p. 542]. The bait should be sown broadcast in strips one rod apart over the area to be treated. When properly sown broadcast, neither birds nor live stock can obtain an injurious or fatal amount of poison. Remedial measures must be applied as soon as the insects begin to appear, if they are to be successful.

HYSLOP (J. A.). **Wireworms attacking cereal and forage crops.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 156, 27th January 1915, 34 pp., 8 figs.

Elaterid larvae or wireworms must be included among the five worst pests of Indian corn and among the twelve worst pests of wheat and oats. The term "wireworm" is also, though erroneously, applied to the larvae of TENEBRIONIDAE (darkling beetles). *Tenebrio molitor*, L., is common throughout the United States, and its larva, the mealworm, feeds upon products stored in granaries and warehouses. Another genus, *Eleodes*, is found only west of the Mississipi, and attacks cereal crops in the field. The name "wireworm" is also incorrectly applied to several species of millipedes. Wireworms are destructive to cereal and forage crops in the larval stage only, although the adults of certain species (*Limonius discoideus*, Lec., etc.) do considerable damage to the

blossoms of fruit trees in the Pacific North-west, and Fletcher has reported (1892) similar depredations by the adults of two other species, *Corymbites caricinus*, Germ., and *C. tarsalis*, Melsh. The forms attacking cereal and forage crops are exclusively subterranean, with the single exception of *Monocrepidius vespertinus*, F., which Kelly found injuring wheat at Wellington, Kan., by boring in the hollow of the stems and not among the roots. In some regions, where these pests are numerous, it is customary to sow three or four times the amount of seed that would normally be necessary in order to get a good crop. Several hundred species of ELATERIDAE occur in North America. They vary enormously in their habits and some forms (*Alaus*, *Elater*, *Adelocera*, etc.) live in dead or rotten wood. *Alaus* has also been recorded as boring in solid wood, though this is doubtful; other species live under moss (*Sericosomus*). A number of species abound in heavy peat soil filled with humus (*Melanotus*, *Agriotes*, etc.), while some prefer well-drained soils (*Corymbites*), and still others (*Horistonotus*) are most destructive on high sandy land which is very poor in humus. Many wireworms have been recorded as predaceous (*Alaus*, *Hemirhipus*, *Adelocera*, etc.). *Pyrophorus luminosus*, Ill., the large luminous Elaterid of the West Indies, is said to be a decidedly beneficial insect, as it feeds on the *Lachnosterna* larvae in the sugar-cane fields. The introduction of this insect into the southern United States as a natural enemy of *Lachnosterna* is not improbable. Most of the wireworms common in the United States oviposit on sod or very weedy land, but species of *Corymbites* in the dry-farming country of the Pacific North-west are severe pests on land that has been seeded to wheat, by the summer fallow method, for the past 15 years; as this land was originally sage-brush prairie, it probably never was in sod. Several distinct species of true wireworms are pests in the United States, and since they vary more or less in their life-histories, a variation in control is required. It is therefore necessary to determine the identity of the wireworm, and to meet this necessity each species of economic importance is treated separately in this paper, and its description, life-history, food-plants and control measures given. The following species are dealt with: *Agriotes mancus*, Say (the wheat wireworm) *Horistonotus uhlerii*, Horn (the corn and cotton wireworm), *Corymbites inflatus*, Say (the inflated wireworm), *C. noxius*, Hyslop (the dry-land wireworm), and the corn wireworms, *Melanotus communis*, Gyl., *M. fissilis*, Say, and *M. cribulosus*, Lec. Mention is also made of *Corymbites cylindriformis*, Hbst., as occurring in enormous numbers in lucerne and wheat fields about Hagerston, Md., in the spring of 1914. In Europe, the habits of *Corymbites pectinicornis*, L., *C. castaneus*, L., *C. siaelandicus*, Müll., *C. aeneus*, F., and *C. latus*, F., have been recorded by Schiödte and Perris. A number of wireworms, though not serious pests to cereal and forage crops over extensive areas, are, during certain seasons, very destructive in restricted localities. Those belonging to the genus *Limonius* are among the most important of this group and include *Limonius confusus*, Lec. (the confused wireworm), and *L. californicus*, Mann. (the sugar-beet wireworm). Owing to the confusion of *Cryptohypnus abbreviatus*, Say (the abbreviated wireworm), with *Drasterius elegans*, F., the literature relating to either of these insects is very unreliable. *D. elegans* has been noted as predaceous and as being a pest of crops, but the author thinks it possible that the

predaceous form is *D. amabilis*, while the crop pest is probably *C. abbreviatus*. The author has found a very young *D. amabilis* eating a pupa of *Meromyza americana*, Fitch, and according to Dimmock, it also devours locust eggs. Another genus of importance among the minor wireworms is *Monocrepidius*, especially *M. lividus*, De G., *M. vespertinus*, F., *M. bellus*, Say, and *M. auritus*, Hbst., the first being the most important. *Asaphes decoloratus*, Say, has been recorded as a pest in New York State and as attacking clover in Illinois. An outbreak of *Lacon rectangularis*, Say, has just occurred in Kansas. This species has not previously been known as a wheat pest. *Cebrio bicolor*, F. (the collared wireworm) has not yet been recorded as an actual pest of crops, but it has been observed feeding on cultivated plants. Four larvae of *Ludius hepaticus*, Germ., were noticed attacking cruciferous plants in Florida.

Birds are probably the most important factor in natural control, and a list of 90 species known to feed on ELATERIDAE, compiled from the records of the Biological Survey, is given here. Other enemies are: *Phrynosoma douglasii*, a small lizard, called the sand toad in the desert regions of the North-west, of which several varieties inhabit the more southern desert lands of the West, where they are known as horned toads; mites (TYROGLYPHIDAE), a Gamasid and *Chelifer alaus*; Therevid flies (*Thereva egressa*, Coq., *Psilocephala aldrichii*, Coq., and *P. munda*, Coq.) and a Proctotrupid; and parasitic fungi (*Penicillium anisopliae*, Vuill., *Metarrhizium anisopliae*, Metch.).

Besides the control measures special to each of the more important wireworms, a number of measures that have been suggested from time to time are reported on, in order to prevent the repetition of the more or less costly experiments made to determine their value. This paper deals with them under the three headings: (1) Seed treatment to prevent insects eating the seed; (2) introduction of poisonous or noxious substances into the soil; and (3) cultural methods. The latter are the only ones which have, so far, proved to be of practical value. Foot-note references to 39 works are given.

RUTHERFORD (A.). **Bark-eating Borers of Cacao and Tea.**—*Trop. Agric., Peradeniya*, xliv, no. 1, January 1915, pp. 34–37.

The caterpillar of *Arbela quadrinotata* (the bark-eating borer) tunnels into the bark of branches or stems; in this shelter it remains by day, emerging only at night to feed. The feeding ground is covered by a canopy of frass bound together with silk which gives the plant a neglected appearance. The injury is indirect, the wound providing an entrance for white ants or fungi. Caterpillars with similar habits have been reported from Kurunegala on *Berrya ammonilla* (Halmilla, Trincomalee wood), and from Assam, in Cachar and Sylhet, on tea. The Indian species is *Arbela tetraonis*, and bores also in lichi, bair, guava, mango and orange. In the case of *A. quadrinotata* the tunnel formed opens near the base of a branch; its walls are often crimson in colour. A description of the larva and pupa is given, and the differences between these and the corresponding stages of *Zeuzera coffeae* (the red borer), are described. Another insect, of similar habits, is the Hepialid, *Phassus malabaricus*, from tea roots in India. The larva bores downwards into the root from the soil level. Another

species, *P. purpurascens*, from Ceylon, bores into the stem of *Cinchona succirubra*. In dealing with these pests, various methods have been used. The caterpillars may in some cases be reached with a wire probe. Carbon bisulphide may be injected into the tunnel and the latter closed. In the case of the Halmilla trees, kerosene was substituted for carbon bisulphide and was reported to be successful.

Antigua: Report on the Botanic Station and Experiment Plots, for the Year ended March 31st 1914.—*Agric. News, Barbados*, xiv, no. 331, 2nd January 1915, p. 11.

Exophthalmus esuriens (the Leeward Islands root-borer) is credited with extensive damage to the maize crop, and considerable loss in the cane crop. It also seems likely to give trouble on lime plantations.

Green (W. J.), Selby (A. D.) & Gossard (H. A.). **Spraying Program for Orchards, with Combinations Recommended.**—*Ohio Agric. Expt. Sta., Wooster*, Circular no. 149, 4th January 1915, pp. 53–60.

This circular consists of instructions as to when to spray and what spray to use for apple, pear, plum and peach trees. Bordeaux mixture, 4–4–50 formula, plus 3 lb. of lead arsenate to every 50 (U.S.) gallons; "self-boiled" lime-sulphur and arsenate of lead, 3 lb. to every 50 (U.S.) gallons; arsenate of lead 3 lb. to 50 (U.S.) gallons and nicotine sulphate, 1 part to 700 parts of spray; and ammoniacal copper carbonate are among the dressings recommended. By a "self-boiled" lime-sulphur is meant a mixture in which the whole of the heat required is obtained as a result of the chemical action of the lime on the sulphur.

Girault (A. A.). **Notes on Trichogrammatidae (Hymen.).**—*Entom. News, Philadelphia*, xxvi, no. 1, January 1915, p. 32.

Trichogramma minutum, Riley, is recorded as parasitic on *Olene pinicola*, Dyar, in Massachusetts and Wisconsin. *Oligosita sanguinea*, Gir., has been reared from cold storage material, mostly leaves and stems of lucerne, accompanying cocoons of *Hypera variabilis* (*Phytonomus posticus*) collected at Portici, Italy. It has probably been introduced into Europe in connection with the importation of grasses.

Laurent (P.). **Army Worm Plague in Philadelphia (Lep.)**—*Entom. News, Philadelphia*, xxvi, no. 1, January 1915, p. 36.

Cirphis (*Leucania*) *unipuncta* (the army worm) is always more or less common near Philadelphia and proved a veritable plague in 1914. Contrary to the generally accepted theory that the caterpillars destroy the grass down to the ground, the author found that they often left from a quarter to a half inch of the base of the blade standing. The moth often becomes a plague when a wet season follows a dry one. The young larvae of the first brood were noticed about 6th July, and were full grown about 1st August, and about a week later the adults began to emerge. The second brood of adult larvae was noticed about 18th September, but was not so numerous. Spraying with lead arsenate, scattering dry, slaked lime, and the use of a mixture of Paris green and bran were the controls adopted.

Cockayne (A. H.). **The flax-grub.**—*Jl. Agric., Wellington, N.Z.*, x, no. 1, 20th January 1915, pp. 1–7, 5 figs.

Phormium flax is one of the most important of the secondary rural products of New Zealand. Though the total value of the 65,000 acres growing it and of the machinery necessary for extracting the fibre is only about £1,750,000, the annual value of the fibre crop exceeds £600,000. The most serious injury to flax swamps is due to the "flax-grub." Until quite recently it was thought that the native slug, *Athoracophorus* (*Janella*) *bitentaculatus*, was the agent concerned, and in the annual report of the Department of Agriculture for 1909, T. W. Kirk and the author definitely stated this to be the fact. During the past summer the author has been able to ascertain that this is not the case. Larvae taken from freshly injured flax were bred out, and the Geometrid moth, *Xanthorhoe praefectata*, emerged in mid-November. Until they pupated, the larvae were fed on flax leaves and produced the typical injuries that had previously been attributed to the slug. A large number of adult *Athoracophorus*, as well as eggs, were collected. In no case did they injure fresh flax leaves, and on hatching, the young slugs throve well on quite rotten leaves, indicating that they normally feed on the decaying herbage that is found in large quantities at the bases of the flax plants. *Xanthorhoe praefectata* was, until quite recently, regarded as a comparatively rare insect. It has apparently increased enormously of late years in flax swamps, owing probably to draining and the setting up of favourable conditions. Diseased leaf is comparatively absent in swamps that become flooded periodically. The almost total destruction of the insect-eating water-fowl and swamp-birds, formerly so abundant in the flax areas, has probably aided the spread of the pest. There seem to be two periods in the year when fresh injury is apparent—namely, in September, October, and November, and again in March and April. This would indicate that this species of *Xanthorhoe* is double-brooded, so far as the southern end of North Island is concerned. It is at present impossible to suggest any remedial measures likely to be of practical value.

Report on the Botanic and Experiment Stations, St. Kitts-Nevis, for the Year ended March 31st 1914.—*Agric. News, Barbados,* xiv, no. 333, 30th January 1915, p. 39.

St. Kitts was not very seriously affected by sugar-cane pests during the year, though it appears that the grub of *Exophthalmus esuriens* is capable of inflicting a great deal of damage as a root-borer, and immediate precautions should be taken against it. The termites, which seriously attacked canes in one district some years ago, seem to have been adequately controlled by the measures advised by the entomologist of the Imperial Department of Agriculture. During this season preventive measures have greatly lessened the damage done by the cotton-worm. The leaf-blister mite has been troublesome only in fields in the neighbourhood of those on which old cotton plants have been allowed to remain.

Porter (C. E.). **Dos cóccidos nuevos para Chile.** [Two Coccids new to Chile.]—*Bol. Museo Nacional, Santiago (Chile)*, v (1913), April 1914, pp. 363–364. [Received 14th December 1914.]

The discovery in Chile of *Asterolecanium variolosum*, Ratz., new to South America, and *Dinaspis* sp. are recorded. The latter was found on *Maytenus boaria*, Mol., and is new to science

Taylor (Miss A. M.). *Eriophyes ribis* **(Nal.) on** *Ribes nigrum*.—*Jl. Agric. Science, Cambridge*, vi, no. 2, May 1914, pp. 121–128. [Reprint received 13th May 1915.]

This paper deals with the mode of migration of *Eriophyes ribis*, Nal. (the black currant mite), and also with its mode of existence from the time when migration to other plants becomes necessary in March, owing to the death of the buds on which the mites have lived for the preceding nine months, to the time when they are found in the new buds in May. In March, April and May, the mites emerge from between the leaves of the deformed bud and distribute themselves over its outer surface. If the temperature is low, they return to the interior of the bud. Under favourable weather conditions the mites become extremely active, leaving the buds and making their way down the stem, but by far the greatest number crawl actively about the bud, suddenly standing erect from time to time. On a calm day they may be seen in this position for several minutes, apparently waiting for the wind to carry them away, for distribution is effected mainly by the agency of the wind. There are three other methods by which the mites are distributed at this period : (1) By clinging to passing insects, such as bees, thrips, etc., and being carried by them to surrounding trees ; (2) by being carried up with the developing shoot, in the event of the " big bud " surviving the attack, or, in the case of the bud being killed, by crawling to surrounding shoots ; (3) by springing from the big bud to other parts of the tree. The two last-named methods would ensure re-infestation of the attacked tree. The day temperature during the migratory period varies roughly between 50° and 100° F. At 50° F. few mites emerge, but when the thermometer rises above 80° the mites become extremely active and the erect position is generally adopted. Each bud may set free about 1,000 mites an hour under favourable conditions, so that one bush may be a source of infestation to all neighbouring orchards. In a cold late spring, a late exodus of the mites will take place. The condition of the bud is a third factor, for some buds, and the mites within them, die before conditions are suitable for migration, and others, although green and succulent, remain so tightly closed that the mites within are imprisoned. It would appear from an experiment that no migration took place from buds which were dry ; those which were nearly dry and those which were closed gave approximately the same number of emerging mites, while from the green expanding buds and those which were becoming dry, the most active migration occurred. Mites of the genus *Phyllocoptes*, but not *Eriophyes ribis*, were found under the loose bark that is shed annually by the black currant. The surface of the earth round the trees was examined, and although a few mites were found their numbers were so small that this did not appear to be their natural habitat. With

a strong lens it was possible to see mites actually blown on to young shoots and leaves, and when their movements were followed, it was found that eventually they made their way to the petiole mostly along the veins, which are smooth and over which they made rapid progress. On reaching the base of the petiole they disappeared between its upper surface and the main stem, where the bud eventually appears. Dissection of such a leaf base showed that a small colony of mites had established itself in this position. *E. ribis* therefore feeds and reproduces on these succulent inner surfaces until the buds, which are almost invisible, are large enough to be entered. As the season advances, the tissues of the lower leaves of the young shoots harden. This causes most of the mites to leave those leaf bases which no longer give them nourishment and to migrate to those nearer the growing shoot. They also creep in between the minute bud and the main stem, and it is in this position that they are usually found when present in the older leaf bases of the shoots. Examination of the bud scales which persist for some considerable time round the bases of the new shoots shows that the mites take shelter there ; they also collect in the leaf scars and probably feed on the oil glands there. At the end of May, the buds of the current year's growth are entered by the mites, and it is within them that the life-history is continued until the migratory period in the spring of the following year. The impossibility of obtaining uninfested stock interfered with an experiment to find out to what extent new shoots are infested by mites carried by the wind, and the presence of some disease—probably bacterial—and the ravages of the parasitic fungus, *Botrytis eriophyes*, interfered with another experiment undertaken to find out to what extent infestation occurs from a big bud to the shoot growing from it.

TAYLOR (Miss A. M.). *Eriophyes ribis* (**Nal.**) **on** *Ribes grossularia.*—*Jl. Agric. Science, Cambridge*, vi, no. 2, May 1914, pp. 129–135, 1 fig. [Reprint received 13th May 1915.]

When *Ribes grossularia* (the gooseberry) is attacked by *Eriophyes ribis*, Nal., no abnormal growth of the buds takes place, as is the case with *Ribes nigrum* [see above], but while the tissues of the expanded leaves and shoots of the latter show no sign of injury, they are severely blistered and deformed on the gooseberry. The mite only migrates by the agency of the wind, when on the gooseberry, to a limited extent, the general method being that of crawling from the scale leaves of the attacked bud to the shoot developing from it. An examination of the attacked bud of the gooseberry shows that no mites are present in the true leaves of the bud, but that they collect on the succulent portions of the scale leaves which surround them. They are found here from the time when the buds are entered in early summer until the spring of the following year. Large blisters, which are characteristic of an attack by *E. ribis* on this host, are formed on the surface of the scale leaves. These fall off, when they have served their purpose of protecting the embryonic shoot which they enclose. The injury is therefore not permanent and the bud remains normal, because the mites do not enter the true leaves and deform them. The blistering and deformation of the expanded leaves and shoots of the gooseberry are due to the

fact that the mites, when the buds expand, crawl from the scale leaves into the young developing shoot and puncture the delicate tissues of the still folded leaflets, the petioles and the main axis. The continuous suction causes large, raised and often confluent blisters on both upper and under surfaces of the leaves. The petioles of the leaves and the young main axis show the same malformations. All parts of the fruit blossom are deformed in the same way and fruit in consequence fails to set. When the leaves expand the mites still continue to perforate the tissues until, after a bad attack, the whole leaf surface, the veins and the petiole become covered with succulent outgrowths. These excrescences, besides giving a plentiful supply of food material, afford the mites a means of protection. The bases of the ribs of the leaves especially are surrounded by a mass of these outgrowths, and beneath them are found colonies of mites, nymphs and eggs. Leaves so attacked are considerably below the normal size, and the main stem is reduced in length. The leaf colour is yellow-green, and the tree has an unhealthy appearance. As the season advances the leaves harden and these excrescences lose their watery contents and become dry and discoloured. The injured epidermis frequently cracks and the injured bark splits and comes away from the stem. Practically all the injury done to the vegetative portions of the gooseberry occurs in the spring and early summer when the trees are making active growth. Later in the season the texture of the leaves becomes tough, new growth is made slowly and hardens quickly and the mites find a difficulty in obtaining a food supply. Therefore, when the buds of the current year's growth are large enough for the mites to enter, they are found to collect in the scale leaves and it is in this position that their life-history is completed. The difference in the method of migration of *Eriophyes* on black currant and on gooseberry is due to the fact that the gooseberry buds are not killed. Shoots develop normally from them, the mites have their food at hand and it is unnecessary for them to adopt a uniform migratory action. A comparison of the number of mites present at different stages of their life-history on the two host plants, *R. nigrum* and *R. grossularia*, shows that, before migration takes place in spring, the number of mites on black currant is countless, while a few hundreds only are to be found on the scale leaves of the gooseberry. A few weeks after the buds have expanded, the mites on the gooseberry have innumerably increased, while only a few can be found in the leaf bases of the black currant. Nor does the mite on the black currant appear to be numerically so strong as that on the gooseberry until the new buds are entered, when a phenomenal increase takes place. The mite on the gooseberry, on the other hand, appears to receive a check to reproduction when the buds are entered. The check to the increase of the mites on the black currant at the migratory period is undoubtedly due to the excessive loss of life caused by the hazardous method of distribution, whilst that on the gooseberry ensures the safe arrival of most of the mites. The distribution of *E. ribis* on *R. grossularia* appears to be as universal as on *R. nigrum*, and most orchards are infested, although symptoms of attack are not always conspicuous. The black currant is so badly crippled after a serious attack that it is of little use to the grower; the gooseberry has its growth checked early in the season, but recovers later on: *R. rubrum* (the red currant) appears to be the least injured.

Da Costa Lima (A.). **Sobre algunos curculionideos que vivem nos bambus. I.** [On some Curculionidae living in bamboo stems. I.]—*Memorias Inst. Oswaldo Cruz, Rio de Janeiro*, vi, no. 2, 1914, pp. 117–123, 2 pls.

A small cultivated kind of bamboo, commonly called Indian cane (*cana da India*), frequently suffers from the attacks of the weevil, *Erethistes lateralis*, Boh. The larva and imago feed on the soft substance lining the cavities of the bamboo joints, where the egg is deposited by the female after piercing the stem by means of its rostrum. The eggs are laid in several adjoining internodes, one in each, and the female bores a circle of contiguous holes in the wall of the joint, underneath the lowest one which contains an egg. Sooner or later the stem breaks at this place. The larvae hatch out after five days and consume the inner layer of the joint, and larvae bred in the Indian cane may be transferred to the common bamboo, which may also be used as food for the imago. Though not precisely determined, the duration of the larval period may be assumed to last some months at least. A natural enemy of this Curculionid, *Prodecatoma cruzi*, sp. n. (Chalcidoidea), is described. The Hymenopteron deposits its egg on that of *Eresthistes* as soon as the latter is laid. The imago emerges by boring a cylindrical hole through the wall of the bamboo stem, often using the perforation made by the beetle. Eggs and larvae, probably of *E. lateralis,* were found by the author at Alto da Boa Vista, Tijuca Mountains (Rio), in another species of bamboo from which a few specimens of *P. cruzi* were also bred. Indian cane is also attacked by the Tenebrionid, *Acropteron rufipes*, Perty.

Bloesler (W.). **Notes on the Life-History and Anatomy of** *Siphona plusiae* **Coq.**—*Ann. Entom. Soc. America, Columbus*, vii, no. 4, December 1914, pp. 301–306, 2 figs.

Specimens of the Tachinid, *Siphona plusiae*, obtained by the author, were parasitic in the larvae of *Phryganidia californica*. The adult female lays one or more eggs on the outer body wall of the host larva. After hatching, the larvae enter the body of the host, where they remain from 10 to 14 days. Hymenopterous hyperparasites were also bred; these will seriously check the beneficial work of *S. plusiae*, which has greatly aided in controlling *P. californica* in California.

McGregor (E. A.). **Four New Tetranychids.**—*Ann. Entom. Soc. America, Columbus*, vii, no. 4, December 1914, pp. 354–364, 1 fig., 4 pls.

The following new species of phytophagous mites are described:—*Tenuipalpus bioculatus* on privet and strawberry, causing defoliation, especially in the autumn. Schwarr's insecticide gave satisfactory results, and lime-sulphur was practically as good. *T. yothersi* was found on camphor leaves in Florida and on oak, elm, and pecan in South Carolina. In spite of the exposed position of this species on the top of the foliage, very little control seems to be exerted by rain. *T. banksi* was collected from the under surface of castor beans and velvet bean leaves. This important pest is controlled by a predaceous mite (*Sciulus* sp.) and by the Coccinellid *Stethorus* sp. *T. quinquenychus* was found on castor bean.

GROSSHEIM (N. A.). **Ячменная тля** (*Brachycolus noxius*, **Mordwilko**.) — **«Труды Естественно-Историческаго Музея Таврическаго Губернскаго Земства.»** [*Memoirs of the Natural-History Museum of the Zemstvo of the govt. of Taurida, Simferopol*, iii], 1914. pp. 35–78, 11 figs., 2 tables.

It is only since 1900 that serious attention has been paid to *Brachycolus noxius*, Mordw., which is one of the most dangerous pests of field crops. Although outbreaks of it occurred before that date, it appears from a short account of the references to this aphid in Russian literature that it was frequently mistaken for *Aphis cerealis*. It was first described by Mokrzecki in 1900, and in that year was responsible for a loss in the crop of barley in Eupatoria, government of Taurida, amounting to 76 per cent. of the average. It was in the same district that the author conducted observations on this pest in 1913. According to both Mokrzecki and Kurdjumov, *B. noxius* appears in May, the author, however, is of opinion that it occurs much earlier, but that the small number of individuals which survive the winter may escape notice. The winter is passed in the egg, which is deposited either on winter-sown barley or mostly on self-sown plants that are largely destroyed by cattle and by ploughing in autumn and spring. These aphids only rarely winter on winter-sown wheat. Although very few colonies of lice were found on 16th June and the number in each colony was small, both these figures increased greatly after the 21st of that month. While the numbers are small they live at the base of the ear or inside the sheath of the covering leaf. Later, when the crops ripen and the numbers increase, they concentrate on the green parts of the plant, on the tip of the ears, or as low down as the first node of the stem. In the middle of June the colonies consist of adult parthenogenetic wingless females, larvae of various stages, nymphs and winged colonising females, all these stages being described and figured. The excreta and remains of the wingless forms, which pass all their life inside the tube, drop down to the bottom of the sheath and decompose, filling up, in the case of large colonies, the whole of the tube. It was not possible to ascertain the duration of life in nature, but in captivity the wingless individuals lived 15 or 16 days and the winged ones 12 to 14 days. The migration of the winged adults takes place usually during the morning hours, and it is thought that they may be carried by wind over several miles. The first individuals were observed on winter-sown wheat and the migration to barley started after 21st June, their numbers on the latter plant increasing daily. The chief damage is done in June, affecting both the form, colour and time of ripening of the crop. The damage to wheat is less than that to barley, owing to the aphids appearing in large numbers only when the wheat is already well developed and the ears have partly emerged from the sheath. Barley is attacked at a time when it is unable to withstand the pest; the development of the ear is delayed and the upper two or three leaves often do not unfold at all. Thus damage amounts to either the total loss of the harvest, in case of young barley, or to a considerable decrease in the case of wheat or older barley. At the end of June, when the grain is nearly mature, the increase of the aphid is at its height. With the ripening of the plants the conditions become less favourable and the numbers drop

rapidly. After the harvest, and until the germination of the fallen grain, the aphids apparently feed on the remnants and waste of the harvest, although according to Mokrzecki they then live on grasses such as *Hordeum murinum*, etc. The practice of some small farmers of mowing a part of the barley while still green for forage leads to the appearance of seedlings from fallen grain at the time of the harvest, and assists the aphids at this time. In the first half of October the sexual forms appeared and were observed in the open up to the first frosts, the resulting eggs hatching in the following spring.

The influence of physical conditions on these aphids is next dealt with. A temperature of 75° F. to 100° F. is required for their development, a decline and especially a rise in the thermometer proving fatal to them. A temperature of over 100° F., accompanied by dry winds, produces a death rate of 75 per cent. Wind has a greater importance than moisture, owing to the increased effects of temperature it produces and also to its influence on the distribution of the winged forms.

The following natural enemies of *B. noxius* are recorded :—*Limothrips cerealium*, Naly., and *Haplothrips tritici*, Kurd., which cause a folding of the sheath-leaf in the same way as the aphids and often seem to drive the latter from the plants. The author has not been able to verify the statement of A. Mordwilko that *Anthocoris* sp. were present in the leaves infested with aphids. Two species of *Chrysopa* were observed in the aphid colonies, the larvae, which are mostly found in June and July, destroying large numbers. *Coccinella 7- punctata* and *C. 14-punctata* were observed destroying the lice, especially in June and July. The larvae of the Syrphid, *Sphaerophoria* (*Melithreptus*) *scripta*, were found in June and July in the colonies of *B. noxius*, devouring large numbers. From the puparia of these insects the hymenopterous parasites, *Homotripus signatus*, Grav., *Encyrtus aphidivorus*, Mayr, *Pachyneuron* sp., and a parasite resembling the Ichneumon, *Bassus laetatorius*, though distinct from it, were obtained. The *Chrysopa* larvae also devoured those of *S. scripta*. The larvae of *Syrphus auricollis* and *S. annulipes*, which also feed on the aphids, are parasitised by *Bassus laetatorius*. *Leucopis argentata*, Heeg., was specially active during the time the lice have to feed on the remnants of the harvest ; from the puparia of these insects *Xana nigra*, Kurd., sp. n. (subfamily APHELININAE) was reared, but apparently the parasite is not of great importance. *Aphelinus hordei*, Kurd., often infested whole colonies of *B. noxius*. Imagines were obtained on 28th August, the males emerging from undersized individuals and females from large ones. Some importance is attached to a small, unidentified spider which lives inside infested ears and weaves its web round the spikes. It not only destroys several aphids a day, but the web prevents their migration. In the absence of experiments on remedies against this pest, the author is only able to suggest general methods tending to improved cultivation, such as timely ploughing and sowing, care during harvest, removal of seedlings from fallen grain on roads and fields, early harvesting when the grains are still firmly attached to the ear, manuring with mineral manure, rolling and harrowing infested fields, trap-crops combined with grazing cattle, black fallow in winter, etc. Spraying, although useful when the aphids are exposed, cannot be recommended, being too costly. A list of 14 works on the subject is given ; 12 of these are Russian.

ADRIANOV (A. P.). **Отчетъ по полевымъ вредителямъ.** [Report on pests of field crops.]—**« Отчетъ о дѣятельности Энтомологическаго Бюро за 1913-1914 г.г.»** [*Report on the work of the Entomological Bureau* (of Kaluga) *in 1913–1914.*] Published by the Zemstvo of the govt. of Kaluga, *Kaluga*, 1914, pp. 67–88; 12 figs., 1 chart. [Received 4th May 1915.]

This report is almost entirely devoted to observations on various species of ELATERIDAE, conducted in the district of Kozelsk, Kaluga, where outbreaks of these pests have occurred since 1912. The adults appeared early in May, the great majority of the insects being *Limonius aeruginosus*, Ol., which disappeared on 28th June. *Agriotes lineatus*, L., was on the wing until 7th July, *Agriotes sputator*, L., until 16th June, while *Agriotes obscurus*, L., and *Athous niger*, L., occurred in small numbers. The maximum number was present about the middle of June, during the blossoming of rye, the inflorescence of which appears to be the favourite food. The imagines of *L. aeruginosus* were specially active during clear, warm days, while those of the genus *Agriotes* are found in somewhat greater numbers during the evenings. The beetles occurred mostly on winter-sown crops, less frequently on summer-sown ones, on clover, in meadows and on boundaries of fields. The females of *Agriotes lineatus* and *A. sputator* oviposited in the earth, eggs left on the surface perishing. The eggs and larvae of *A. lineatus* and *A. sputator* are described and a table is given showing the growth of these larvae during the first year of their life. *Agriotes* larvae in captivity eat sugar-beet and carrots, in the presence of which they did not touch potatoes. They also attacked each other, and they were observed to kill the larvae of *Bibio marci*, L. The larvae of *Athous niger* did not touch either beet or carrots. The pupae occur in the soil at a depth of 3 to 6 inches, at which depth the larvae also were usually found. The pupal stage lasts 2 or 3 weeks, but the period over which pupation occurs extends over the whole of July and August. One ploughing therefore of the soil during the pupation period will only lead to the destruction of a small percentage of pupae. Experiments are described on the influence of mineral manure (basic slag) in minimising the damage to crops, but they proved that the larvae were practically not affected. Heavy rains, producing a large amount of moisture in the upper strata of the soil, drive the larvae deeper down and thus the amount of rainfall may affect them.

The other pests of field crops reported during the year were: *Anisoplia cyathigera*, Scop., adults of which were first observed on rye on 17th June, their numbers increasing to the maximum at the end of that month and the insects disappearing in the middle of July; no serious damage was caused by them. *Anthothrips aculeatus*, F., was frequently found in rye ears; *Ochsenheimeria taurella*, Schiff., occurred everywhere; *Hydroecia nictitans*, L., *Trachea basilinea*, Schiff., *Euxoa segetis*, Schiff., and *Feltia exclamationis*, L., were also very common.

SVJATOVITCH-BIELIKOVA (A. V.). **Отчетъ о работахъ въ 1914 году.** [Report on the work in 1914.]—**« Отчетъ о дѣятельности Энтомологическаго Бюро за 1913-1914 г.г.»** [*Report on the work of the Entomological Bureau* (of Kaluga) *in 1913–1914.*] Published by the Zemstvo of the govt. of Kaluga, *Kaluga*, 1914, pp. 89–106. [Received 4th May 1915.]

The author reports on the work which she has carried out in the fruit-growing district of the government of Kaluga. The necessary appliances and insecticides were supplied free by the Zemstvo at a total cost of about £40, while the peasants undertook to carry out all the work required. The chief pest of fruit trees is *Aporia crataegi*, L., the caterpillars of which began to issue from the winter nests on 3rd May. Pupation started on 24th May; about 4 per cent. of caterpillars were parasitised by *Apanteles* sp. and another 4 per cent. died from unknown causes. It was thought that the small percentage of caterpillars infested with the parasite is due to the action of the peasants, who destroy the cocoons of the parasites, which they regard as offspring of the caterpillars. The percentage of pupae infested with *Pimpla* and other parasites was 33; another 15 per cent. did not produce imagines from unknown causes. The imagines appeared on 9th June, and oviposited on apple, pear, thorn, plum, cherry, medlar and service trees. The new brood of caterpillars emerged on 10th July and skeletonised the leaves, which, however, did but little harm to the trees; after a week the caterpillars moulted and soon afterwards prepared their winter-nests. The campaign against these pests has been carried on in the district since 1910, principally by removing and destroying the winter-nests, better results being obtained when this is done in autumn, as otherwise the nests blown down by the wind remain in safety till the spring. In the year under report, belts of adhesive material were laid on 14,430 trees, the total cost amounting to about £30. They were made from parchment paper, tied with raffia, and the cost of a single belt was about $\frac{1}{2}$*d*. Experiments conducted with tanglefoot and some glue of Russian manufacture proved the good qualities of the former.

The larvae of *Psylla mali*, Först., appeared on 8th May, and after 2 or 3 days they penetrated into the buds, where they remained till the unfolding of the leaves; the nymphs were noticed on 17th May and the winged adults on 29th of that month. The campaign against them was conducted chiefly by fumigating with tobacco dust, which was carried out on an area of $94\frac{1}{2}$ acres. The adults of *Anthonomus pomorum* appeared on 3rd May, and were specially numerous in those orchards where they were present in the previous year, showing that the weevils, having emerged from the buds, remain over the winter near their place of origin. The larvae appeared on 19th May, pupation started on 30th May and the weevils emerged on 19th June. The control of these pests consisted in spraying and coating the trunks with lime and applying trap belts. The caterpillars of *Cheimatobia brumata* were noticed inside the buds of trees in the middle of May, where they remained till the end of that month, when they emerged and attacked the leaves, and the stamens and pistils of the flowers; pupation took place in the earth after 9th June. Spraying with Paris green, $3\frac{3}{4}$–5 oz., and double that amount of lime in 27 gallons of water,

proved effective. The pupae of *Cydia pomonella* were found in the earth underneath apple trees in the first half of May; the adults appeared on 7th June, and were on the wing till the 14th July. Although there was much fallen fruit in June, the percentage of apples infested was not great. No imagines of the second generation were observed. Control took the form of collecting the fallen fruits, which served as food for cattle. The caterpillars of *Hyponomeuta malinellus*, Zell., were found on 8th May when the leaves were not yet unfolded. Four per cent. of the caterpillars were infested by Chalcid and other parasites; 16 per cent. perished from unknown causes. Control consisted in the collection of the nests. Hatching of the caterpillars of *Malacosoma* (*Lasiocampa*) *neustria*, L., began on 3rd May; pupae appeared on 10th June and the adults on 23rd June. *Aphis pomi* (*mali*, F.) appeared mostly on young trees, but in small numbers; hatching took place on 9th May, the winged forms appearing at the end of that month. The numbers of *Aphis sorbi*, Kalt., were also small. Various species of COCCIDAE were found on apples in large numbers. Injury from *Scolytus* (*Eccoptogaster*) sp. was noticed, but no beetles were found. Other pests were:—On raspberries, *Byturus tomentosus*, F.; on currants, *Aphis* sp.; HALTICIDAE; *Pieris brassicae*, L., and *Aphis brassicae*, L., which have entirely ruined the cultivation of cabbages in the district. Caterpillars of *Euxoa* (*Agrotis*) *segetum* have destroyed some 68 acres of crops, the caterpillars mostly coming from the boundaries of the fields.

ROEPKE (W.). **Wetenschappelijk Onderzoek.** [Scientific researches.]—*Meded. Proefst. Midden-Java, Batavia*, no. 18, 1914, pp. 14-23. [Received 4th March 1915.]

The parasites of *Acrocercops cramerella* (cacao moth) have occupied the greater part of the time of the Director and his staff. Attempts have been made to rear several species of spiders in captivity, with the idea of obtaining a supply of eggs for infection by the moth parasite. It was found very difficult to raise the spiders at all and almost impossible to get them to oviposit, and they proved to be quite unmanageable in captivity, chiefly owing to slow development and their cannibal habits. A new host-insect was discovered in the coconut pest, *Brachartona catoxantha*. Parasite species C. readily infected the cocoons, but species A. and B. refused them [see this *Review*, Series A, i, p. 57]. *B. catoxantha* might well serve as an intermediate host for species C., but there are two difficulties in the way; the insects will not pair in captivity, and they must not be allowed to escape because of the damage they do to the coconuts. Great attention has been paid to new parasites, and several have been found, including three Ichneumonids, designated species D., E. and M. respectively. D. is a *Calliephialtes* found in but small numbers, and those almost always males, so that rearing was impossible. Research on Chalcids gave better results; hitherto, these insects have only been known as hyperparasites of the cacao moth, but two have been discovered and designated respectively species X. and species Y., which are primary parasites. The females of species X. infect the caterpillars at the moment of commencing pupation and also fresh pupae. The larva

develops at first entozooically but later ectozooically, and as a rule there is but one parasite to each cocoon. If there be two, the insects are of small size. They were fairly numerous at the end of the first harvest of 1913 and probably have some practical importance. Species Y. is a very small black Chalcid; several develop in one cocoon, and as they reproduce parthenogenetically, there is hope of being able to raise them in quantity. *Phanurus* (*Ceraphron*) *beneficiens* and the native *Trichogramma australicum minutum* and *Trichogrammatoidea nana* were tried, but *Phanurus* is too large and the *Trichogramma* refused to have anything to do with the cacao moth cocoons. Observations on a large mass of living material has shown that a small percentage of parasites undergo an aestivation period of about a month's duration. The pupal stage apparently begins but does not continue, and the larva acquires a thick parchment-like integument and so remains until the rains, when true pupation takes place; no difference was, however, observed between the resulting imagines and those produced in the ordinary way. Species B. is specially prone to this peculiarity. Species C. acts also as a hyperparasite on the caterpillars of the Limacodid, *Setora nitens*, which are often killed by a Braconid larva. The introduction of parasites of the cacao moth to Assinan is reported to have yielded most excellent results. A campaign against wild food-plants must be undertaken and this is the more necessary as a caterpillar has been found on a leguminous tree, *Saraca declinata*, which so closely resembles that of the cacao moth as to lead to the suspicion that the aboriginal insect and its food-plants have been discovered. The tree is largely planted for ornament in gardens and parks, but is also to be found wild; numbers of other trees growing near cacao plantations showed no sign of cacao moth infestation. The perfect insects when bred out were not absolutely identical with the cacao moth, and may be a new species of *Acrocercops*.

Helopeltis did more damage than usual in the year under review, 1913–14, and attention is drawn to the great quantities of its food-plants grown for ornament, while the wild food-plants are also on the increase. The *Zeuzera* borer is also stated to have done much damage. *Xyleborus coffeae* has been found to be attacked by a Chalcid, probably of the genus *Apostrectus*, and such large numbers have been bred out from coffee branches attacked by the borer that it is difficult to understand why the parasite is not more effective. Investigation is not easy because the Chalcid is a night-flyer and daylight studies on the spot are almost useless. This habit, and the want of a coffee garden close to the station, made the laboratory work difficult. Infestation tests on a small scale in captivity succeeded and showed that even the unfertilised females can reproduce, though only males result. The method of infestation could not be observed, as it probably takes place at night, and during the day the parasite took no notice whatever of the borers.

A pest of kapok, apparently identical with *Arbela tetraonis*, Moore, from India, and new to Java, is recorded. It also attacks other trees, especially Leguminosae, and has been found on cacao.

A caterpillar borer of the kapok pods, which is occasionally very numerous, is under observation, and a number of pupae are being reared in order to determine the species. Coca is suffering from the attack of *Prodenia litura* (*littoralis*), of some species of *Boarmia*, and of a brown

Tortrix. Cinchona growers are complaining of the damage done by an undetermined "bag-worm." Pepper corns are bored by an unknown pest, and *Hevea* branches have been killed in serious quantity by a Bostrychid. A species of *Gunda* has almost stripped the leaves of *Ficus* in the Government plantations, and caterpillars of *Ocinara waringii* have done much damage to other crops. *Hevea* and *Ficus* have suffered seriously from *Cyrtacanthacris* (*Acridium*) *melanocorne*; *Castilloa* resisted attack, and *Robusta* coffee was not greatly affected.

Roepke (W.). **De Praktische Toepassing der Motparasieten.** [The practical employment of the (Cacao) Moth Parasite.]—*Meded. Proefst. Midden-Java, Batavia*, no. 18, 1914, pp. 25–27. [Received 4th March 1915.]

As the season for plucking cacao nears its end, the numbers of *Acrocercops cramerella* steadily increase. On those plantations on which the moth parasites are numerous the damage is not so great, though the control exercised by them cannot be considered complete. The percentage of parasites rises with the increase of the moth towards the end of the plucking. At the moment when the "rampassen" operations [see this *Review*, Ser. A, i, p. 57] begin, a large number of parasites should be present in the last-infected cocoons, which will emerge in a few days. As the adult parasites are long-lived, the females, which appear first, living at least six weeks, at the end of the rampassen many thousands of parasites should be present, as against the small number of cocoons which have been overlooked on the pods.

But for the presence of hyperparasites, the parasites might be released in plantations without further consideration. Means must, however, be taken to secure a maximum of parasites during, and especially towards the end of, each plucking, and *per contra* to keep down the hyperparasites at these periods. Laboratory studies have shown how this may be accomplished. The test must be made on a plantation in which the parasites already exist. A number of native boys who have been previously instructed in moth-cocoon collecting are set to work in the plantations. Collections are made about every sixth day in the same area and the cocoons taken to a central station and sorted by an expert into parasitised and non-parasitised, and the percentage calculated. For control purposes, all the non-parasitised cocoons are kept in special cages until the moths emerge, the greatest precautions being taken against their escape. The parasitised cocoons are sorted into parcels of 10, which are laid out on white paper and covered with a tumbler. Each plantation should have 250 or more such glasses in readiness and a specially constructed rack so arranged as to make full observation easy. Every day a number of parasites emerge, and the observer in charge notes on the white paper each day the number, species and sex, and allows them to escape, the cocoons being then destroyed. As the hyperparasites emerge, they will be more or less visible under the glasses, and the observer must give his undivided attention to them, as emergence is almost constant. They must be immediately dealt with by stupefying with a wad of wool soaked in gasoline, and, after examination with the lens and determination of sex, destroyed. As a rule, all the parasites will have

emerged in 14 days. This work must be carried on unceasingly until no more cocoons are to be found in the plantation. The parasites are to be maintained at the end of the operation by collecting attacked pods, laying them in heaps and covering them thickly with cacao leaves. In two or three days a quantity of cocoons will be obtained, and the pods and cocoons should be hung up in the parasite examination shed and the cocoons subjected to the same process of examination as those collected from the plantations. The method appears to be laborious, but an intelligent native can be taught all that is necessary and men trained by the central station are sent to those plantations which need them and cannot secure their own. The plan works best on a plantation of moderate size. Any excess of parasites may be collected and sent to plantations that need them. Proper control by the central station is very necessary, to see that the work is done by competent persons and that the hyperparasites are properly sorted out and destroyed. If the method were universally adopted the author thinks that, under well-defined conditions, " rampassen " operations might be replaced by parasite propagation.

KEUCHENIUS (P. E.). **De Biologie van eenige Koffiecicaden.** [The Biology of some Coffee FULGORIDAE.]—*Meded. Besoekisch Proefst.*, [*Djember, Java*], no. 13, 1914, pp. 1–8, 2 pls. [Received 3rd March 1915.]

Two Fulgorids, the black and white *Lawana* (*Poeciloptera*) *candida*, F., and *Pochazia fuscata*, F., are here dealt with. Two years ago Dr. Wurth noted in the reports from the Experiment Station at Malang that certain plantations were invaded to an alarming extent by *L. candida*, *Coffea robusta*, Lamtoro (lead tree), *Hevea* and dadap (*Erythrina*) being especially affected; later reports showed that great damage had been done by the insects sucking the juices of the young plants. Dadap was the most attacked, *Coffea robusta* came next, and then Lamtoro and *Hevea*. The eggs are laid on the leaf ribs and stems, cuts being made by the female in which she lays her eggs in regular rows, the total number amounting to several hundreds. A figure is given of a section of a dadap twig showing that the bast is so thin that the ovipositor reaches the cambium; the eggs are covered by an outgrowth of the epidermis which forms a kind of lid to the cut. Careful examination of a line of eggs laid on the midrib of a *C. robusta* leaf showed no damage to the vascular bundles, as the covering parenchyma forms a sufficiently thick protection. The egg stage appears to last about three weeks; the larvae are entirely covered with a white, woolly, waxen material which remains for months on the trees after the insects have left.

Pochazia fuscata, F., is practically unknown to the planters and is not even mentioned in the literature of the Dutch East Indies, but at the beginning of 1914 it invaded the coffee plantations of one district in such numbers as to be a veritable plague; a much smaller outbreak occurred in the previous year, but no notice was taken of it. *P. fuscata* has only made its appearance in any numbers on one plantation, and in this almost exclusively on *Coffea robusta*, a few only occurring on dadap. On the coffee the eggs were laid on the leaf veins on the under side, and on dadap on the stems. The two species can readily be distinguished with the naked eye in the egg stage.

P. fuscata lays its eggs in rows; generally only two rows are laid and these almost always on the midrib of the leaf. No long cuts are made in the epidermis as in the case of *Lawana*, but one puncture for each egg, which is closed in much the same way by an overgrowth of the plant tissue. Larvae were difficult to find, but like those of the other species, are covered with a white waxy material. The differences between the larvae of the two species are described and care is required to distinguish between them. From one specimen of *Lawana* a parasitic hymenopteron was reared, and in one case the Pyrrhocorid bug, *Dindymus rubiginosus*, F., was observed sucking a full-grown *Lawana*. Neither species appears to have any insect enemy of importance, but the numbers of *L. candida* are largely reduced by a fungus of the family Entomophthoraceae which thrives under the moist conditions afforded by the west monsoon; the fungus spreads so rapidly that the insects are killed *in situ* and their bodies completely covered by it; it is suggested that the planters should cultivate the fungus and maintain a supply of it, so that as soon as the pests appear they may be infected. No fungus disease or parasites of *Pochazia* were discovered. The damage done results in a diminution of the coffee crops and is, according to the planters, serious, but young plants seem to be able to bear a heavy attack by *Lawana* without suffering greatly, and the author failed to connect the precise statements of loss made to him with the insects. He states that, in his opinion, millions may attack a plantation without doing much harm, because, so far as his information and the results of experiments go, the period from newly hatched larva to perfect insect is at least 6 weeks, and possibly double this time, and this slow development carries with it the inference that the quantity of sap required for nourishment is very small, and it is hardly probable that the saliva injected into the minute wounds made can have any injurious effect on the trees.

Keuchenius (P. E.). **Een Nieuwe Klapperplaag.** [A New Coconut Pest.]—*Meded. Besoekisch Proefst.*, [*Djember*], no. 13, 1914, pp. 11–20, 1 pl. [Received 3rd March 1915.]

In the course of 1913, complaints were received of a pest which was doing serious damage in coconut plantations by causing the flower buds to abort. When an attacked bud was opened a number of insects were often found in it, but a caterpillar appeared to be the real cause of the damage. An attack by caterpillars of this kind being entirely new to the planters, the matter was investigated, and the pest found to be especially active on two adjacent estates between 500 and 700 feet above sea-level. The caterpillars were bred out and found to be those of a Pyralid, *Melissoblaptes ruforenalis*, Snellen. The sexes, which differ both in form and colour, are described. The pupa is contained in a cocoon of brown silk, intermixed with excrement and fragments of flowers, and is difficult to distinguish from its surroundings. As soon as the flower sheath opens the young caterpillars become visible. They bore into both the male and female flowers and eat out the stamens and ovary; the hard scaly leaves are left, and when one flower has been destroyed they travel to others and repeat the operation. It is obvious from the nature of the attack that the effect of the pest on the yield of copra is most serious. In some cases very young nuts were

attacked by larvae which had wandered from the neighbouring flowers. The larval stage was found to be 3–4 weeks in the laboratory. The pupae are generally to be found near the flower sheath between the side shoots, only rarely on the nuts. The pupal stage lasts 7–11 days; the imago lives several days and the sexes are approximately equal in number; oviposition may take place without fertilisation, but whether such eggs are fertile was not determined; the whole life-cycle occupies about 40 days. The pest was at its worst from the beginning of the previous east monsoon, so that there is no period of winter rest in the life of the insect. It would appear that the part of the plantations attacked was that nearest to the forest. The pest appears to be already spread all over Java, but only the fact that one or two plantations were badly attacked caused it to be brought to the author's notice. On one of these the harvest had been estimated at 60 tons of copra, but only a little over 1 ton was gathered, the bulk of this loss of $98\frac{1}{2}$ per cent. being attributed to this pest. Among the insects found in the putrid flower mass produced were the earwig, *Exypnus pulchripennis*, Burr, and the weevils *Rhabdocnemis interruptocostata*, Schaufuss, and *Diocalandra frumenti*, F. (*stigmaticollis*, Gyll.); there is some ground for suspicion that the last-named helps to complete the damage done by *Melissoblaptes*. Experiments with *Exypnus* showed that it would not eat the flowers until they were beginning to rot. The insect was further observed on several occasions to attack and kill the larvae of *Melissoblaptes*. Only three parasitic Hymenoptera were raised from 120 caterpillars, so that these are of small account as natural enemies. The great height of the trees and the nature of the attack make any attempt at control by spraying useless. Cutting out and burning all attacked buds and young nuts is also useless, as this operation does even more damage to the crown of the tree than the insect. Trapping with sugar, flavoured with vanilla, was tried in the hope of attracting the females, as the males have a strong odour of vanilla, but this did not succeed, nor were light traps of much use. The males only fly by night and very few were caught. The young coconuts are attacked in New Guinea and the Sandwich Islands by a similar pest, identified by Preuss as *Phryganodes* (*Omiodes*) *blackburnii*, Butl., in the latter country.

Keuchenius (P. E.). **De betekenis van twee bekende mieren, in verband met het groeneluizen-vraagstuk van de koffie.** [The significance of two known species of ant in relation to the green coffee scale.]—*Tijdschr. Teijsmannia, Batavia*, no. 10, 1914, pp. 711–716. [Received 7th April 1915.]

Two species of ant are very common in coffee gardens and are firmly believed by the planters to encourage the spread of *Coccus viridis* (*Lecanium viride*) (the green coffee scale). These are *Oecophylla smaragdina* and *Plagiolepis longipes*, both of which foster green scale. The planters are so convinced that *Plagiolepis* assists the dispersal of the scale that they lose no opportunity of destroying the nests. There is no doubt whatever that this ant makes use of the scale for its own purposes, but the author, as the result of his own observations, strenuously denies that there is any connection whatever between the spread of the scale and the ant. The ants clearly follow the scales,

but may often be found where no scales are and the scales are never found in the ants' nests. The scale was successfully cultivated on coffee trees absolutely isolated from ants and even on branches carefully isolated by rings of tanglefoot from the rest of the tree on which the ants were found, and it is by no means uncommon in a coffee garden to find trees badly infested with scale but entirely free from ants. It is difficult to understand how the idea that the ants spread the scale arose, and still more how Zimmerman, Neumann and Pandan could have supported it. It is possible that an ant has been seen carrying a scale, but this was probably an accident, as this species never travels far from its nest. On the other hand, *Plagiolepsis* is a very useful insect, as it undoubtedly assists the spread of the white scale-fungus, *Cephalosporium lecanii*, by carrying the conidia from one scale-insect to another. *Oecophylla smaragdina* is also very common in the coffee gardens and is a cause of great annoyance to the labourers, who are badly bitten by it, especially at plucking time. This ant is widely distributed over Asia and Polynesia, and when it finds scale-insects on leaves, protects them by binding down the neighbouring leaves with web so as to make a cover for them. To this extent this ant may be regarded as harmful to coffee, in that it protects *C. viridis* from many of its natural enemies.

Goot (P. van der). **De Stengelschidluis** (*Chionaspis tegalensis*, **Zehnt.**) **en hare bestrijding.** [The (sugar-cane) stem scale *Chionaspis tegalensis*, Zehnt., and its control.]—*Meded. Proefst. voor de Java-Suikerindustrie, Soerabaia*, iv, no. 30, 1914, pp. 655–688, 9 charts. (Reprint from *Archief voor Suikerindustrie in Ned.-Indie*). [Received 19th January 1915.]

Zehntner, in 1897, was the first to publish notes on the sugar-cane scales, and recorded four species:—*Odonaspis* (*Aspidiotus*) *secreta saccharicaulis*, Zehnt., *Chionaspis madiunensis*, Zehnt., *Chionaspis tegalensis*, Zehnt., and *Chionaspis* sp. The first-named was found almost exclusively on *Saccharum soltwedli* and is thus of minor importance, and Zehntner did not regard any of the four as of real consequence. Cutting out the attacked canes or rubbing them down with a cloth soaked in petroleum emulsion was considered a satisfactory method of control; it was suspected that the introduction of the pest had some relation with the young plants. Nothing more appeared in sugar-planting literature until 1911, when Van Deventer drew attention to the damage done by *C. tegalensis*. This results not only in an obvious diminution of the total yield of sugar, but also of the weight of cane, and Van Deventer estimated the financial loss at about 22 per cent.; he gave but little indication as to how the pest was spread, and the wind carriage of the larvae was suggested as a plausible theory. Infection from the young plant was excluded, because the insect would not live long on it when buried underground. Van Deventer was of opinion that a large proportion of the scales, especially on the upper parts of the canes, escaped the wiping process above mentioned. The serious infection of the experimental cane field of the Station afforded an opportunity for studying the question in the course of the year 1913. The pest was common on *Saccharum officinarum*, but was found to be capable of living on other species—*e.g.*, on *S. soltwedli* and

S. spontaneum and as every variety of cane grown at the station was attacked, it is probable that all are susceptible ; even Black Cheriton, which is supposed to be immune, suffered. The sugar-cane stem-scale is covered practically throughout its whole life by a rounded white shield of a waxy consistency, and is to all intents and purposes immobile, remaining attached by its mouth-parts to the surface tissue of the cane. Almost the only movement made by the insect is that necessary for the larva to extricate itself from the egg ; it moves but little from the place on which it was hatched and attaches itself almost immediately. Propagation is rapid and abundant ; every female lays 60–80 eggs and maturity is reached in 4 or 5 weeks, so that the gravity of an attack is readily understood. The pest is found almost exclusively on the stems ; occasionally it occurs on the leaf sheath or at the base of a leaf, but appears rarely to mature in these positions. It is generally noticeable about February, the joints becoming hidden with a thick white covering. The wiping process is costly and not satisfactory, because large numbers of the insects are left on the upper parts of the canes behind the leaf sheaths, and in some fields it is the practice to cut off the tops if they are badly infested. The natural enemies of the scale are of the greatest importance to the planter. *Chilocorus melanopthalmus*, Muls., is peculiarly voracious and devours the scale more or less completely. The eggs are laid under the shield, usually one to each scale. The larvae hatch in 7 days, begin their work the moment they emerge, and continue it for about 10 days, when they are full-grown and pupate ; five days later the imago appears. This Coccinellid in Java does not confine itself to *C. tegalensis*, but also attacks *C. saccharifolii*, Zehnt., boring one or two small holes in the shield and apparently dragging the scale-insect through them. It has also been found feeding in company with *Aleurodes longicornis*, *Coccus viridis* (*Lecanium viride*), Green, *Aphis sacchari*, Zehnt., and *Pseudococcus* (*Dactylopius*) *sacchari*, Cockerell, but these were not attacked. The destruction of *C. tegalensis* is, however, remarkable. *C. melanophthalmus* is only occasionally found in the coffee gardens, and is there apparently replaced by *Orcus janthinus*, Muls. Two parasitic Hymenoptera have been found attacking the scale and have been submitted to Mr. Girault for identification. The attacked scales become hard and brown and are readily recognisable. One species develops very rapidly, lays about 30 eggs and reaches the imago stage in from 10 to 14 days, so that there is reasonable hope of help from it in keeping down the scales, though, owing to the mechanical conditions, it will be unable to reach those on the tips of the canes. Besides these natural enemies, two other Coccinellids, one a species of *Scymnus*, are perhaps of consequence. The larvae of species of *Chrysopa* appear to frequent the scale-infested canes, and the author has observed that certain caterpillars (one of them he believes to be that of *Euproctis minor*) which ordinarily eat the cane leaves, frequently gnaw away the whole of the shield of the scale. The other is a grayish black hairy caterpillar which the author was unable to identify.

The presence of the scale has to be taken into serious consideration in setting out a new plantation, as the scales may be introduced on the sets or, according to Van Deventer, may in their very earliest stage be carried by the wind ; this the author regards as only barely possible, in view of the known facts as to the habits of the scale. Van Deventer

has asserted that this scale will not survive burying in the ground, although there are undoubtedly species which are not affected by such treatment. The matter was put to the proof by planting a large number of sets of several varieties and, two months after planting, living scales were still to be found on the sets. There may possibly have been a second generation, though the number was markedly less than when the sets were planted, and it is at least clear that burial in the soil is not favourable to the scale. Three and a half months after they were put in the ground numbers of full-grown scales were found on certain of the sets, while others were free, possibly owing to the large development of the leaf sheaths. The general result of this series of experiments, which are set out in great detail, was that five months after planting almost every plant of the many varieties tried showed the presence of scale. The insects were, however, not numerous and in a certain number of cases entirely absent ; young larvae were hardly ever found. It is noted as a remarkable fact that the scale was never found on that part of the stock which was above ground. It was further observed that there was more scale on those plants raised from sets from which the old leaf sheath had not been removed. Comparison of plantations leads to the belief that the nature of the soil is an important factor, the pest being more prevalent on light soils than on heavy, and that certain standard varieties of cane are less affected than others. The author regards it as clearly proven that the infection can be carried by the sets and that, in his experiments, the question of possible wind carriage does not arise, for no scales were found in the control (originally scale free) rows of plants. This being the case, the question arises as to how infection may be avoided and how the sets may be freed from scale. An emulsion of 12 per cent. carbolineum and another of 40 per cent. petroleum with soap and water was tried, and it was found that either was sufficient to kill all scales on the sets, and prolonged and careful trials showed that the carbolineum emulsion strong enough to kill the scale had no effect on the sets themselves, but that petroleum was not satisfactory in this respect. The sets were dipped in the emulsion for 10 to 15 seconds in wooden tanks and then set aside to drain thoroughly ; it was found necessary to keep the emulsion in the tank incessantly stirred, otherwise drops of pure carbolineum separated out and damaged the sets ; the emulsion, even at 15 per cent., did not harm the hands and arms of labourers employed in dipping, and it further served as a most excellent fungicide against the pineapple fungus, *Thielaviopsis*, rendering the use of Bordeaux mixture unnecessary. The results of lengthy comparative trials of carbolineum, tar and Bordeaux mixture are given, from which it is clear that certain varieties will not bear the carbolineum treatment at all and that others bear it well, especially the variety described as 247 B., and even the 10 per cent. emulsion seemed effective ; petroleum even at 30 per cent. killed over one-third of the sets ; Bordeaux mixture is absolutely useless against the scale as a contact poison, but scarcely a plant that had been treated with 2 per cent. milk of lime showed primary scale infection ; wiping with a rag soaked in paraffin is a common method and is apparently successful, but many young scales near the " eyes " of the set escape, and this is precisely that stage which best resists burial in the soil. The objection to the wiping method is that it is costly in time and labour and is liable to be carried out perfunctorily

and therefore ineffectively, whereas the dipping method with a solution of carbolineum of a strength suitable for the particular variety is rapid, efficient and inexpensive. With regard to wind carriage, the author thinks that this is not only theoretically possible in the case of the very young larvae, but that it actually occurs. A planting of young canes cleaned with petroleum and rendered, as far as it was possible to be sure of it, free from scale, stood at a distance of a little over a yard from a block of one year old Kasso cane, heavily infested with scale. About a month after the sets had been planted the young plants were found to be infested above ground on the leaf sheaths with very young scale larvae, and the position of the larvae and their distribution among the plants clearly pointed to infection from the Kasso, as it extended about 10 yards into the young plantation; two months later a further quantity of very young larvae were found on the short stems. The author is more or less satisfied that these young larvae were wind-borne. Secondary infection or the spread of the scale through a plantation may arise from the same cause, especially among the tops of the canes. In conclusion, it is urged that, owing to the rate of propagation, especially in January and February, this pest should be closely watched for and the infested plants destroyed at once.

WOODHOUSE (E. J.) & DUTT (H. L.). **The Campaign against Surface Caterpillar at Mokameh in 1913.**—*Bihar & Orissa Agric. Jl., Patna*, ii, 1914, pp. 16–35, 2 maps, 2 plates. [Received 30th March 1915.]

The authors' previous success with the Andres-Maire traps seemed to make it certain that the spread of the moth in the district would be checked by the use of 25 of them. This paper is a minutely detailed account of the operations and the local conditions prevailing over the low-lying, periodically flooded area at Mokameh, known as a *tal*. In one place there was evidence that the moths escaped from the traps and investigation showed original defects of construction, which were successfully remedied by placing horizontal strips inside the slits and the use of a sticky liquid on the inside of the framework of the trap. By the middle of November the catches suddenly began to increase enormously and continued high throughout the month, and the traps were kept in position till the end of January when the first parasitised caterpillars were found. The damage due to *Agrotis ypsilon* is put at 37 per cent. In 1912 the dates of the three broods were September 5th–15th, September 25th to October 20th, and November 1st to December 15th and the catches in thousands 3, 55 and 76 respectively. In 1913 the date of the first brood was not traceable, but the second was from October 5th to November 5th, the third from November 13th to January 10th, the catches in thousands being 49 and 794 with 35 traps in use against 25 in the previous year. The great differences in the figures for the two years are largely explained by local conditions, but it appears to be more or less clear that the bulk of the damaged areas were outside the areas protected by the traps. The attracting liquid, used in 1912, was composed of gur 65 per cent., ethyl acetate 0·6 per cent., water 34 per cent., and alcohol 0·6 per cent.; this was found to be too sticky, and a mixture of equal parts of gur and water with the other ingredients was substituted and gave equally good

results. The alteration in the traps by fixing horizontal strips along the slits and so prolonging the entry and making exit very difficult was a great improvement, increasing the catch by over 20 per cent. Attempts to discover the sites of aestivation of the moths have again failed, but it is more or less clear that it cannot occur on any part of the *tal* lands. The life-cycle has been found to require about one month at Mokameh. The proportion of males to females increases as the season advances, thus in September it was 1 : 1·45, October 1 : 2·19, November 1·28 : 1, December 2·75 : 1. The traps appear to catch the females before they have laid half their eggs, as appears from a table showing the results of the dissection of several hundred moths. Regarding the first appearance of this pest on the *tal*, it is usually stated that it first began to do serious damage some 15 years ago, though no explanation was forthcoming as to the cause of the outbreak. Some information was obtained from a Malpur land-holder which throws light on this question. It was said that up to about 14 years ago there used to be high embankments round most of the higher areas of the *tal*, which enabled these lands to be used for rice and bhadoi crops. These areas eventually became partitioned among a large number of petty holders, who did not take the trouble to repair their sections of these embankments. In the case of the Paijuna *tal*, an area of some 7,300 acres originally belonged to one holder, but has since been subdivided among 45. If these statements are true they explain the increase in the damage done by the pest during recent years. The addition of a large acreage of high lands, which emerge from the flood considerably earlier than the low lands and provide a nursery for an early brood, has enabled an additional brood to be produced on the *tal*, with the result that the number of the moths flying on to the low areas to lay their eggs has been increased to many times its former number. It appears that the insect does not aestivate near the *tal*, for no diminution of the moths has occurred as a result of the work of the two previous seasons. The first moths oviposit during the last days of August on the fallow rice areas surrounding the *tal*, which at that time are the only areas above water; the bulk of these moths escaped the traps and the caterpillars matured on uncropped land; the moths from them, emerging in October, flew into the lower areas from which the water was then draining away, laying their eggs on low areas not usually subject to attack; absence of parasites greatly aided them. The increase of damage in the past season was due to the fact that the first brood, which it is most essential to destroy, was produced out of reach of the traps. Tables are given showing details of the catches in the traps from August to January. The heaviest catches per night per trap was 569 in December, as against 156 and 118 in November and January respectively.

DUTT (H. L.). **The Potato Tingid** (*Recaredus* sp.).—*Bihar & Orissa Agric. Jl., Patna*, ii (double no.), 1914, pp. 36–47. [Received 30th March 1915.]

This pest was first noticed about 4 years ago in the potato stores at Tunia, near Bettiah, where it is known as "dhil"; its distribution is still very limited, but it may spread into equally favourable regions to the north of the Ganges, where the humidity is distinctly higher than in the south Gangetic area. The pest does serious damage to stored potatoes by sucking out the sap and renders the tubers useless

for seed or for food. The eggs are laid anywhere on a potato, but never on the sprouts or directly on an eye bud. As the female shuns light the eggs are always laid on that side of the tuber which is furthest from it. The egg-laying capacity is probably enormous, as the adults live seven or eight months. The various stages are described. As the insect is long-lived and oviposits many times during its life it is hardly possible to speak of distinct broods, but in the laboratory the cycle from egg to adult was found to be about four weeks and the possibility of at least seven distinct broods in a year was demonstrated. The first insects appear in the godowns soon after storing, but the then prevailing dry conditions prevent rapid multiplication. The method of storage prevents proper observation, as the potatoes are put into baskets and stored on staging in the godown and are never touched or disturbed during the whole storing season, so that the cultivator does not see the pests till they have multiplied to such an extent as to be obliged to come to the surface to find food, and it is probable that at least one if not two broods occur before the break of the monsoon in June. Hibernation in the egg stage is very improbable, considering the conditions required, and as neither maturing nor oviposition occurred in the laboratory from the end of December to the beginning of March, it is almost certain that hibernation takes place in the adult stage. Both as nymph and adult, the insect sucks the sap from the cortical cells under the skin of the potato and the work begins immediately after hatching. The excreta stain the potato skin yellow, and when the colony is numerous late in the season, the entire tubers become moist, as if dipped in water ; this excretion in a few weeks turns a sooty black. Though the pest only operates over a limited area at present and will probably only spread slowly by natural means, the loss to the cultivators is very serious. There is also danger of its mechanical spread, as Bettiah is a very important centre for the export of seed potatoes in the Tirhut Division. The annual crop has risen from 600 tons in 1908 to over 1,500 tons at the present time. This export goes on all the year except December and January, and the traffic during the latter part of the storing season can only be regarded as risky in the extreme, although it is obviously useless to attempt to sell badly infested tubers. No parasites of any kind have been found, but the common red ant, *Monomorium indicum*, Forel, attacks the pest freely. The preventive measures suggested are control of the potato traffic in places where the pest is prevalent and destruction of infested material. The method of storing is largely to blame for the increase of the pest and four tests were made with a view to improving this. Four equal quantities of potatoes were stored, each in eight baskets as follows :—(1) In baskets without mud or sand covering (local method), (2) in baskets plastered with mud and covered on the top with dry sand, (3) as (2) but with naphthalene balls, not sand, (4) in baskets plastered with mud, and covered with sand and with napthalene balls. All affected and rotten tubers were picked out and rejected once a month. The plastered and sanded baskets were practically free, whilst the check baskets were seriously infested. Unfortunately the method induces rotting under the moist conditions of the locality, but worked well in the drier climate of Patna. Further experiments on fumigation, other methods of storage and improved ventilation are in progress and will be reported on.

DUTT (H. L.). **Potato Storage Work in Bihar and Orissa in 1913.** —*Bihar & Orissa Agric. Jl., Patna*, ii. (double no.), 1914, pp. 48–68, 5 tables. [Received 30th March 1915.]

This is a record by districts of the results from potato storage under sand, which is being urged upon the local growers as a good method of saving their stock from pests. Details are given as to the percentages saved, rejected and lost. Fungus disease was difficult to combat, and the following facts in the life-history of the potato moth (*Phthorimaea operculella*) are pointed out as important. The moth first appears in the field a few weeks before the crop is ready for harvest and lays eggs on the eyes of the exposed tubers in the ridges; the larvae bore into these and feed on them. After harvest these bored potatoes are carried to the godown with the sound ones and it is here that the bulk of the damage is done, as the conditions favour the increase of the pest; one moth may lay from 100 to 150 eggs and, in the laboratory at Sabour at all events, 14 broods a year are possible. The life-cycle in the laboratory varied from 18 to 21 days from June to October, rose to 30 in November, to 54 in January, fell to 40 in March, to 23 early in April and through April, May and later, 17 to 18 days. The pest gradually disappears from a godown in August and September, but occasionally may be found as active in October and November as in May and June. The following advice is given to storers of potatoes. The ridges in a potato field should be not less than a foot wide; as soon as the harvested potatoes are fairly air-dried, all with black spots on their eyes and all bruised and cut tubers should be picked out and only healthy ones stored. Potatoes should never be stored on floors, but always on staging covered with matting on which an inch of sand is laid; the tubers are to be stacked on this in one uniform, thin layer not exceeding 1 foot in height. After a month, they should be taken out of the sand and all that are apparently attacked rejected and the remainder covered with sand as before. When the moths disappear the heap should be left exposed, but if the moths return it should be covered again at once. Picking should be done once a month in the dry season and more frequently during the rains. By these methods 60 per cent. of the stored quantity may be saved. All affected tubers whether attacked by moth or *Rhizoctonia* should be burned or buried deep, and potatoes from different fields should be stored separately, as infection is apt to be local.

RICHARDS (P. B.). **Note on the Occurrence of three Caterpillar Pests on Coconuts.**—*Agric. Bull. Fed. Malay States, Kuala Lumpur*, iii, no. 2, November 1914, pp. 43–45.

In June 1914, a caterpillar pest was reported on coconut palms. From the larvae kept under observation, adults were bred and identified as *Hidari irava*, *Erionota thrax*, and *Corone palmarum*, all belonging to the HESPERIIDAE. The first two are distributed throughout the Malay Peninsula, feeding on wild palms. Precise details of the life-histories are unknown. Eggs are laid on both sides of the frond; the larva passes through the pupal stage in the folded leaf. The whole cycle probably occupies from 6 to 8 weeks. The larva connects together with silk the two edges of a pinna, thus forming a tunnel in which it

lives. No preference is shown for young or old leaves or for young or mature trees. The whole of the tissue of the leaf segment, except the midrib, is destroyed. Hence any poison applied must cover the entire leaf, must be insoluble and adhesive, and also innocuous to the foliage. Lead arsenate spray, $1\frac{1}{2}$ lb. of lead arsenate paste to 60 gals. of water, to which has been added 10 lb. of slaked lime, has proved most satisfactory. Spraying should be begun as soon as an attack is observed. If the caterpillars are fully grown, it is useless to spray until the next generation, since only a small portion would be affected. The pupae should be collected and placed in a box, one side of which is formed of wire netting of $\frac{1}{4}$ inch mesh. The parasites, which emerge at pupation, can thus escape to continue their attacks. The box must be inaccessible to ants, which are liable to destroy the pupae.

Richards (P. B.). **Methods and Materials for the Control of Insect Pests (Part I.).**—*Agric. Bull. Fed. Malay States, Kuala Lumpur,* iii, no. 3, December 1914, pp. 123–126.

Important factors in the natural control of insects are the action of climate, insectivorous birds, predatory insects, parasitic insects and fungi, and the distribution of food-plants. An imported injurious insect may find itself free from parasitic enemies and so increase rapidly if suitable food-plants are available. Legislative measures which attempt to control such pests apply generally to importation and transportation of plants which may be infested. Cultural measures are important to countries growing annual crops of the kind which do not lend themselves readily to chemical or mechanical treatment. Rapid strides have been made in recent years in the control of insects by chemical means, either by spraying, dusting, or fumigation. Stomach poisons are applied to that part of the plant upon which the insect feeds, and are applicable only to certain insects feeding on leaves or tissues on the outside of the plant. Fumigation methods are effective against all kinds of insects, but are especially valuable for those living in stored products. Under mechanical measures are included various methods of trapping the eggs, larvae, or adults.

Richards (P. B.). **Methods and Materials for the Control of Insect Pests (Part II.).**—*Agric. Bull. Fed. Malay States, Kuala Lumpur,* iii, no. 4, January 1915, pp. 145–154. [Received 3rd May 1915.]

Direct injury caused by insects to plants is mainly inflicted in two ways—either the tissues are eaten or the juices of the plant are sucked. Since the majority live on the foliage, the most effective method of eradication consists of poisoning the foliage upon which the insect is feeding. Both vegetable and mineral stomach poisons are used, the former consisting usually of solutions of alkaloids, the latter of arsenic compounds. The substances may be applied either by dusting the solid matter over the leaves or by spraying water in which it is suspended by means of suitable apparatus. Of the arsenic compounds, calcium arsenite is used in the proportion of 1 lb. to 100 or 150 galls. of water; the compound is insoluble in water, but the precipitate is fine and remains in suspension. In this strength it is toxic to all

plant-eating caterpillars, but is also poisonous to cattle. Copper aceto-arsenite (Paris green) is prepared by dissolving 4 lb. of white arsenic in 5 galls. water and mixing with 5 lb. verdigris in 5 galls. water. The mixture is boiled for an hour and a little acetic acid added. The spray is made of 1 gal. of this solution to 150–200 gals. water to which has been added 2 or 3 lb. lime. This compound is not satisfactory as a dusting powder. The spray fluid has to be stirred continually and has the further disadvantage of usually containing some soluble arsenic and copper both of which scorch the leaves. It is effective against all biting insects, but as it is fatal to man and cattle, cannot be used upon fodder, fruit or vegetables. Copper arsenite (Scheele's green) is applicable to the same conditions as Paris green and is equally efficacious. Lead arsenate is more satisfactory in that it has no scorching action on the leaves and is very adhesive. It is obtained commercially in the form of paste ; 1½ lb. of paste to 60–100 gals. water, with 5 to 10 lb. slaked lime forms a suitable mixture. Lead arsenate is less poisonous to man and cattle than Paris green. At the rate of 1 lb. to 100 gals. water with 3 to 5 lb. lime and 5 lb. low-grade sugar, it is effective as an insect poison and is comparatively safe for cattle. A spray containing 1 lb. arsenate in 60 gals. water is most often used ; if the foliage is thick and leathery, the strength should be increased to 1 lb. in 25–30 gals. For skipper caterpillars on coconuts and bananas, a wash containing 1½ lb. paste to 60 gals. water with the addition of 5 to 10 lb. lime per 100 gals. is recommended.

WATSON (J. R.). **Report of Entomologist.** *Rept. Florida Univ. Agric. Expt. Sta., 30th June 1913, Gainesville*, June 1914. pp. liv–lxxi. 4 figs. [Received 15th March 1915.]

Spraying experiments with *Microcera* against white-fly were carried out from January 1912, for a whole year. The spores obtained from cultures on sweet potatoes were sprayed on to the young trees, and whole twigs were dipped into water containing the spores. Except in unfavourable weather *i.e.*, in dry periods spraying with a suspension of *Microcera* spores caused a marked rise in the natural mortality of the larvae, though the effect was only temporary. *Microcera* is less virulent than either *Aschersonia* or *Aegerita*, but acts more quickly : therefore, in spraying with either of the latter it is advisable to add *Microcera* and cultivations of *Microcera* on potato are to be preferred to larvae as a medium. A detailed account of the whitefly in citrus groves and the effect of spraying on them is given. *Aleurodes howardi* (woolly whitefly) was discovered in Arcadia, in December 1912, and from this point has spread rapidly eastward as far as Orlando. The rate of increase, however, is very variable in different districts. Honeydew is secreted more abundantly by this species than by *A. citri*, but the ordinary sooty mould does not develop so well in this case. Other fungi *e.g.*, *Cladosporium* thrive rapidly. The adults are more sluggish than those of *A. citri*, but are more liable to be carried long distances on the clothing of travellers. The life-history is not fully known ; in Lakeland and Tampa adults were numerous on 14th May ; a week later most of them had disappeared, though some were still seen by the middle of June. The food preferences for different varieties of citrus are the reverse of those of *A. citri*, in which grape-fruit is the

first choice, then orange, then tangerine. *A. howardi* seems to be almost confined to citrus, though it has also been reported on mango and guava. A Chalcid parasite of *A. howardi* was found at Lakeland and Tampa. The red *Aschersonia* has been found on this species, but does not infect it readily. Early larval stages yield readily to miscible oil sprays, but this method has little effect on the late larval and pupal stages, on account of the protection afforded by the collection of honeydew.

With regard to other citrus insects :—*Icerya purchasi* (the cottony cushion scale) was reported first from Tampa in 1911 ; since then it has spread eastward. *Leptothrips floridensis* was found under the loose bark on a small tree in the Station grounds. *Heliothrips haemorrhoidalis* was observed on orange trees under glass. The Chrysomelid, *Trirhabda brevicollis*, was found damaging grape-fruit and prickly-ash trees. The insects were controlled by Bordeaux mixture.

In July 1912, velvet beans in the Station grounds were attacked by the grass-worm, *Laphygma frugiperda*, and by the velvet bean caterpillar, *Anticarsia gemmatilis*. The latter is parasitised by an entomogenous fungus, which, in many cases, controls it ; during dry weather, however, the *Anticarsia* nearly destroys the crop. Arsenicals have to be employed in such cases ; since velvet beans are sensitive to these, experiments were conducted to determine the maximum quantity which could be used and the efficiency of this quantity in controlling *Anticarsia*. It was found that, in August, 6 oz. of zinc arsenite to 40 U.S. gals., with 6 to 12 oz. of lime, did not seriously injure the beans, but this strength did not kill all the caterpillars. In December a pound could be used without harm to the plant. In the spring of the next year young seedlings were found to be able to withstand a considerably greater amount. *Cryptothrips floridensis*, a newly recognised pest of camphor, was discovered on camphor leaves in Satsuma, in November 1912. The eggs are laid between the scales of the terminal buds, the developing bud being either deformed or killed by the larvae. The young twigs are then attacked ; the bark dries up and cracks, thus providing an entrance to the cambium, where more eggs are laid. The adults, though winged, are incapable of flight, and are probably spread by contact with men or horses, or by crawling over the ground. Since camphor is not native to Florida it is doubtful whether the insect is a native species or has been imported with the camphor trees. The pest can be controlled by spraying with a solution of a half gallon (U.S.) of whale-oil soap, a half gallon (U.S.) of commercial lime-sulphur and a half pound of Black Leaf 40 to 50 U.S. gals. of water, while the larvae are still in the buds or outside the twigs. [See this *Review*, Ser. A, i, p. 512.]

Caterpillars of the Hyponomeutid, *Urodus* (*Trichostibas*) *parvula*, were received from Seabreeze, where they were defoliating bay trees, and kept under observation. Loosely woven, stalked cocoons were formed, from which the adult emerged in about 10 days. Eggs were laid at once ; larvae hatched out in the early spring. There seemed to be about eight generations in the course of the year. The moths crawl up the trunks of trees to lay their eggs ; the larvae are very active, and can therefore be partly controlled by banding the trees. Spraying with lead arsenate, 7 or 8 lb. to 50 U.S. gals. of water, has been found effective. An account of the first destructive brood of *Laphygma frugiperda* (the fall

army-worm) was given in the last Annual Report. The next brood appeared early in July, and was very destructive over the whole of Northern Florida, as well as in many other Southern States. The August brood was not nearly so abundant. *Alabama argillacea* (the cotton-leaf caterpillar) has been reported in Suwannee County. Although larger broods were found at Live Oak, Gainesville and other places, no general destructive infestation has occurred. Some caterpillars of *Mocis* (*Remigia*) *repanda* were found infesting Italian rye-grass. *Tetranychus bimaculatus* severely infested strawberries and *T. mytilaspidis* occurred on citrus and camphor. *Hemichionaspis minor* occurred on a new host, *Asparagus plumosus*. The Anthribid, *Brachytarsus variegatus*, attacked velvet bean seed and is becoming more abundant.

HEWITT (C. G.). **Control of Insect Pests in Manitoba.**—*Manitoba Agric. College, Winnipeg*, Circ. 26, October 1914, 12 pp. [Received 3rd May 1915.]

Observations extending over a series of years have shown that insect pests destroy on an average from 10 to 25 per cent. of the total crops. Cutworms were very destructive in 1914 in Southern Alberta, destroying about 35,000 acres of grain. New areas of settlement and cultivation provide food for native insects and new lands for immigration of invaders. The effect of such invasions is to increase the cost of production, the increase being due to actual destruction of the crop and the cost of prevention by spraying. Measures essential to insect control are either preventive or eradicative, but before either can be employed the habits, method of attack and susceptible points in the life-history of the pest must be known. Preventive methods aim at stopping the introduction and spread of pests and at protecting the plants themselves. Manitoba is protected against introduction of insect pests by the establishment of the inspection station in Winnipeg. The most important of all measures for the prevention of spreading is clean cultivation. The encouragement of insectivorous birds is of considerable value. To illustrate the method of eradication, measures which have been taken to destroy the chief insect pests of horticulture and forestry in Manitoba are described. Grasshoppers are destroyed by scattering horse-droppings poisoned with Paris green. Cabbages may be protected from root maggot (*Chortophila brassicae*) by means of tarred felt-paper disks placed round the stems of the plants; the adults are thus prevented from depositing their eggs on the roots. Cutworms can be readily killed by poisoned bran mash scattered around the young plants. The larch sawfly (*Lygaeonematus erichsonii*) is a dangerous forest insect, but if restricted to a small area can be controlled artificially. If spread over a large extent its natural enemies must be relied on to check it.

GARCIA (F.). **Report of the Director.** *25th Ann. Rept. Agric. Expt. Sta., New Mexico College of Agric., Las Cruces, N. M.*, 1913-1914, pp. 80–83.

During 1913-1914 the investigations into the life-history of *Typhlocyba comes* and its control have been almost completed. Measures for the control of *Anarsia lineatella*, the peach worm, could not be carried

out extensively owing to the scarcity of the larvae. The presence of many Tachinid and Acarid parasites will probably materially lessen the numbers of injurious grasshoppers during next season. In the tests for the control of the San José scale, lime-sulphur, miscible oils, kerosene emulsion, whale-oil and fish-oil soaps, and soluble sulphur were tried. Kerosene emulsion and lime-sulphur were not effective on peaches on account of the liability to scorch the foliage. Whale-oil soap is useful as a cleanser of large branches, but is not effective on the foliage. An outbreak of *Haltica foliacea* on grapes and young fruit trees was checked by spraying with lead arsenate ($1\frac{1}{2}$ lb. in 50 gals. water). The Harlequin cabbage bug (*Murgantia histrionica*) has been reported from many localities in the State.

Jones (L. R.). **Control of Potato Diseases in Wisconsin.**—*Agric. Expt. Sta. Univ. Wisconsin, Madison*, Circ. 52, November 1914, pp. 1–19, 4 figs. [Received 3rd April 1915.]

Among the insect pests of potatoes, the common potato beetle (*Leptinotarsa decemlineata*) is the most injurious. Thorough control of the first brood, which hatches out when the plants have just appeared above the ground, is most important. Spraying with arsenical compounds at this time destroys the beetles and young larvae. Flea-beetles appear in midsummer, damaging the leaves by puncturing them with small round holes. Bordeaux-arsenical mixture is generally a perfect control. Migrating swarms of grasshoppers often cause serious injury, especially when other green food is not available ; Bordeaux-arsenical spray or bran mash, consisting of 1 lb. of Paris green and 25 lb. of dry bran moistened with molasses or 2 or 3 gals. of water, is effective. The tobacco horn worm (*Protoparce*), which is occasionally found, is best controlled by Bordeaux-arsenical spray applied in early summer, or if the caterpillars are numerous and large, by hand-picking.

Engelhard (F.). **Report of Committee on Potatoes.**—*Seventeenth Texas Farmers' Congress 1914, Texas Dept. Agric., Austin*, Bull. 40. November-December 1914.

The potato-tuber moth (*Phthorimaea operculella*) has become well established in parts of Southern Texas. The larva is largely an enemy of stored stock, making it difficult to keep seed for autumn planting. Treatment with carbon bisulphide in air-tight chambers has been fairly successful. Experiments with cold storage seem to show that the insects are rendered dormant and damage practically ceases for the time, but after removal they again become active.

O'Kane (W. C.). **State Moth Work: Plan and Progress of Work, 1913-1914.**—*Circular no.* 6, *State Moth Work, New Hampshire State Dept. Agric., Concord*, 22 pp., 7 pls. [Received 3rd March 1915.]

The suppression of the browntail and gipsy moths in the State of New Hampshire was made a part of the work of the newly organised Department of Agriculture and the campaign for the year ending 31st August 1914, was as follows :—(1) Suppression of the gipsy moth

in towns along the border of the present infested area, in order to limit spread into the remainder of the State. (2) Inspection of threatened territory outside the infested area, where special danger of new infestation exists. (3) Collection, propagation and colonisation of parasites of both the gipsy and the browntail moths. (4) Co-operation with and assistance of towns, municipalities and individuals throughout the infested areas to ameliorate the damage done by the pests, to assist in control on private and public property, and otherwise to carry out the duties prescribed by the statutes.

Only a part of the State is as yet invaded by the gipsy moth, and the inability of the female to fly limits the manner of its spread and renders scouting on the outer borders of the infested areas very useful; this is done with the co-operation of the Federal authorities. This only limits or retards the spread of the pest, and the more serious work of suppression in already infested areas by colonising parasites and other measures is costly and laborious and the means far from unlimited. All apple orchards and oaks are carefully examined, especially along lines of traffic, as vehicles appear to be the commonest mode of spreading the pest; the forests of the White Mountains have probably been saved from attack by these methods. Inspection marks are painted on trees and also on the nearest point to them on the highway, and in areas infested in the winter of 1913–14, all trees for several yards round the points of infestation were banded with tanglefoot at a height of 5 or 6 feet. Scouting along the main roads northwards of the infested area showed no apparent infestation. The fact that both the browntail and gipsy moth are imported insects makes the use of imported parasitic and predaceous insects difficult, as some of these are not so easily acclimatised as their host and the native American insect enemies of the pest are, at present at all events, of little value. Some of the imported parasites are doing good work, but others tend to disperse rapidly, and not a few multiply so slowly that unless artificially assisted no great results can be expected from them. Two temporary laboratories for this purpose have been established and *Apanteles lacteicolor* has been bred in quantity. Food material was provided in abundance at the right time by keeping brown-tail nests in cold storage. The cocoons of the parasites were sorted out carefully into lots of 1,000 each and taken to suitable places in small weather-proof boxes with perforations on one side through which the insects could escape as they emerged. The boxes were nailed to the trunk of a tree, which was well smeared with tanglefoot to prevent attack by ants. *Anastatus bifasciatus*, a parasite of the gipsy moth, has been similarly distributed in 478 localities of the State in the spring of 1914. Experimental work is now in progress for extensive colonisation of *Schedius kuvanae* in the same way, and if this insect will live as far north as New Hampshire it should be of great value. Eight colonies of *Compsilura concinnata* were distributed, and efforts are being made to spread *Calosoma sycophanta*; attempts to spread the wilt disease have not been satisfactory. Great efforts are being made to interest individual property owners in the question and to secure their co-operation by circulating information, and stress is laid on the importance of careful study of a given infected locality so as to secure consistent and practicable control measures.

Howard (L. O.), **Report of the Entomologist for the year ended 30th June 1914.**—*Ann. Rept. U.S. Dept. Agric., Washington, D.C.*, 1914. [Reprint, 16 pp., received 1st March 1915.]

The results of new work and of progress in the older investigations are summarised in this Report. The gipsy moth was discovered in 118 New England towns, where it had not been previously reported. Very thorough work was carried on to wipe out a colony found in Ohio. In New York State steps were immediately taken against a colony found there. State laws modelled on that of Massachusetts, which requires each municipality to share control, would greatly assist in the difficult problem of preventing westward spread. An enormous decrease of the brown-tail moth is due to the severe winter, to the brown-tail fungus disease, and to the imported parasites. The quarantine inspection of forest products and nursery stock from the gipsy and brown-tail moth areas covered 17,076 shipments; 4,253 specimens of the former nest, and 1,404 of the latter, were found and destroyed. Introduced and other parasites and natural enemies have been more conspicuous than ever before; *Anastatus bifasciatus*, *Schedius kuvanae*, *Apanteles lacteicolor*, *A. melanoscelis*, *Meteorus versicolor*, *Limnerium disparis*, *Compisilura concinnata*, and *Calosoma sycophanta* were all in evidence. In the section devoted to deciduous fruit insect investigations, it is stated that the remedies adopted in certain European countries for the control of the grape *Phylloxera* may perhaps be found effective in the destruction of the root form of the woolly aphis. Proof has been obtained that the cotton-boll weevil has changed somewhat structurally since entering the United States, that it has become adapted to greater severities of climate and is also now able to obtain subsistence and possibly to develop on certain plants related to cotton, among which are *Hibiscus syriacus* and *Callirrhoe involucrata*. In 1913, 17,700 square miles of new territory were infested by the cotton-boll worm, and the primary loss in the cotton area was approximately $30,000,000. The effect of low temperatures upon the different stages of the cigarette beetle has been worked out, and it was found that all stages of the insect can be killed very economically by this method, though the proper handling of tobacco to prevent damage during the change in temperatures is not yet understood. Ammonia gas also promises to be a very cheap and efficient control for this beetle. Work in connection with forest and timber pests led to the discovery that kerosene and linseed oil are effective repellents against the so-called powderpost beetles, and fairly general utilisation of these oils by manufacturers has followed this discovery. In the section dealing with pests of vegetable and truck crops mention is made of a self-propelled sprayer fitted with a light, high-speed gasoline engine pump for use in the onion fields in Texas and Louisiana, where such a machine has long been a necessity for the control of the onion thrips. Dichlorobenzene was thoroughly tested against various stored-product insects such as weevils, beetles, and moths, and against ants, cockroaches, and other household pests. This gas is neither inflammable nor explosive; it apparently is non-injurious to man and domestic animals when inhaled, and products taken directly from the fumigation chamber have been fed to domestic animals with no harmful results. The control of various citrus pests by spray methods as an alternative to fumigation has been taken up in California.

Chapman (R. N.). **Observations on the Life-History of** *Agrilus bilineatus.—Jl. Agric. Research, Washington, D.C.*, iii, no. 4, January 1915, pp. 283–294, 2 plates.

The four common species of oak in the south-eastern section of Minnesota, *Quercus alba*, L., *Q. macrocarpa*, Michx., *Q. rubra*, L., and *Q. coccinea*, Wang, are subject to infestation with *Agrilus bilineatus*, Weber (the two-lined chestnut borer). Members of the black-oak group seem slightly more susceptible to attack than those of the white-oak group, but in localities where infestation is severe, none of the species is exempt. It has often been found that *Armillaria mellea*, Vahl (the shoestring fungus) has apparently been the cause of the weakened condition of the trees, and that the chestnut or oak-borers have followed it. Near Lake Elmo a few dead trees were found with the fungus, but with no traces of *Agrilus* larvae. In other localities the fungus was present, but was not so apparent, and all the dead trees showed traces of oak-borers. Dead trees also showed characteristic beetle injury, but no traces of *A. mellea* were found on examination. The economic importance of this latter fact can hardly be over-emphasised, for it means that the beetles, in spite of their supposed preference for unhealthy trees, chose a healthy one where many trees infested by the fungus were available, thus indicating that the inter-relation between *Armillaria mellea* and *Agrilus bilineatus* may not be of such primary importance as would appear at first. On the 17th June 1914, the first adult beetles were seen and they reached their greatest abundance about 1st July. There was a noticeable decline after the first week in July and by the 20th the last record of adults had been made. Never found until a couple of hours before noon, the adults were most numerous shortly after that time. They then gradually disappeared until only few were to be seen late in the day. The females oviposited between 19th June and 13th July, generally in a crevice at the bottom of a deep crack between ridges of bark. Since the bark is usually rougher on the trunk and lower limbs, especially near the ground, more favourable places are to be found there. On one tree which was very badly infested practically every branch more than $1\frac{1}{2}$ inches in diameter had burrows in it. The larvae on hatching broke through the egg membrane on the side towards the bark and immediately began to burrow. Burrows made during the first instar are made across or with the grain. The burrows of the second instar are wider and about twice as long. At the beginning of the third instar quite a different course was usually found, especially in green bark on the trunks of trees, where the burrows were almost always transverse to the grain of the wood, while those of the fourth instar often attained a length of 20–24 inches. Where the bark was thick these were generally transverse to the grain. At the close of the fourth instar the larva burrows out into the bark if it is thick enough, and constructs a cell in which it hibernates. Here pupation takes place in the spring. These cells are found in the ridges of the bark on the trunk and larger limbs and in the wood of small, thin-barked trees and limbs. It is not surprising that trees infested with *Agrilus bilineatus* appear to die suddenly when larvae are numerous, considering that each individual may consume cambium tissue equal to nearly twice its own bulk every 24 hours. Trees with growing tissue offer the best opportunity for making extended burrows with great nutritive value to the larvae and

to the detriment of the tree. On the other hand, as soon as the tree dies from being girdled the tissue becomes dry, offers more resistance to burrowing and is of little nutritive value to the larvae, which may die. The pupal stage lasts about 10 days, and it seems that the insect in Minnesota normally pupates during the latter part of May and emerges from the cell about the middle of June. Two parasites were noticed : One reared from the larvae, being a species of *Atanycolus*, the other from an egg, belonging to the TRICHOGRAMMATIDAE.

The cutting and burning of infested trees before the emergence of the adults in the spring is an effective means of control. This should not be neglected in the hope that the infested tree will recover the next spring. As other methods seemed imperative, the trunks and large limbs of some trees were sprayed during the past season with an iron-sulphate and lime-sulphur mixture, while others were sprayed with a Bordeaux mixture. This was done as a preventive measure during the egg-laying season, and it seemed successful, as no beetles were seen on the sprayed trees, even though they had been covered with them the day previous to this treatment. In contrast with this, beetles were seen in great numbers throughout the season on the unsprayed trees near by. Other experiments are being made.

BACK (E. A.) & PEMBERTON (C. E.). **Susceptibility of Citrous Fruits to the Attack of the Mediterranean Fruit Fly.**—*Jl. Agric. Research, Washington, D.C.*, iii, no. 4, January 1915, pp. 311–330, 3 figs. 3 plates.

Data secured in the Hawaiian Islands tend to show that even if *Ceratitis capitata*, Wied. (the Mediterranean fruit fly) should obtain a foothold in the warmer portions of the United States, it probably would not be the serious pest to citrus fruits that previously published literature would indicate. These fruits are not the favoured hosts of the fly that the earlier writers thought. They may become quite badly infested with well-grown larvae if allowed to remain on the tree long after they become sufficiently ripe for the market, but larvae are seldom found in their pulp until they are much over-ripe. In Honolulu, where conditions are very favourable to early infestation, owing to the excessive number of flies breeding in a profusion of non-citrus fruits, it is doubtful whether grape-fruit, oranges, and lemons would ever become infested until long after becoming over-ripe if the female fly formed a fresh egg cavity for each batch of eggs deposited, for the reason that many of the eggs and the young larvae found in the egg cavity and in the rag of the rind would be killed by the oil of the cells ruptured in the formation of the egg cavities, while of those larvae which succeed in entering the rag, only a very small number are able to reach the pulp because of the imperviousness of the rag. It is only the persistent attack of successive lots of larvae, hatching from different batches of eggs laid in the same puncture in which the oil has become inoperative, that finally breaks down the barrier between the young larvae and the pulp. Growers in California and Florida are admirably protected from attack by the scarcity of wild host fruits that cannot be destroyed. It will be found a practical undertaking there to remove such a number of non-citrus host plants at present growing near citrus orchards that the succession of fruits in which *C. capitata* can breed during the large

portion of the year when citrus fruits are unavailable for attack because of their greenness will be reduced to a minimum, if not entirely done away with. It is under such conditions that the excessive mortality occurring in the rind will become a valuable factor in preventing infestation or establishment of the pest, as each fruit will in reality become a trap for stray females. The scarcity of host fruits will also make spraying with poisoned baits a practical undertaking should artificial control become necessary. The Mediterranean fruit fly is quickly affected by low temperatures. A temperature of about 56° F. has lengthened the time required from the egg to the adult stage from 14½ to 91 days. A temperature ranging from 50° to 55° F. will either seriously check development or kill large numbers of the immature stages of the fly. The winter monthly mean temperature of California and Florida are so similar to those of the citrus regions of Southern Spain, Italy and Sicily, that it is to be expected that the fruit fly, if introduced to the mainland, would not become a serious pest to *Citrus* spp. It happens that the very cold temperature necessary to bring citrus crops to that degree of perfection in which they are most susceptible to fruit fly attack, likewise renders the fly so inactive and sluggish that it may be disregarded as a pest for that period of the year. The presence of *C. capitata* in California and Florida will be a menace, but the pest can be successfully fought. The article concludes with a bibliography of seven works.

WILDERMUTH (V. L.). **Three-Cornered Alfalfa Hopper.**—*Jl. Agric. Research, Washington, D.C.*, iii, no. 4, January 1915, pp. 343–362, 1 fig., 1 plate.

The popular name "three-cornered alfalfa hopper" is applied to both *Stictocephala festina*, Say, and *S. festina* var. *rufivitta*, Van Duzee, though the validity of the varietal name is considered doubtful. *S. festina* has a wide distribution and is chiefly found throughout the southern and south-western States, but also occurs in very limited numbers in the northern half of the United States. It is seldom found at elevations over 3,000 feet. The general distribution of the alfalfa hopper, and the fact that it is found in isolated places under cultivation, are doubtless due to the wide range of its food-plants and probably also to the presence of native leguminous plants upon which, in all probability, it lives. It is particularly fond of lucerne, *Vigna sinensis* (cowpea), and the various clovers, but it has also been found feeding upon trees, shrubs, herbs, and grasses. The author has found it feeding as well as breeding on *Capriola dactylon* (Bermuda grass), *Sorghum halepense* (Johnson grass), wheat, barley, oats, *Medicago denticulata* (bur clover), *Melilotus officinalis* (yellow sweet clover), and lucerne, which is its principal food-plant. It has also been found on *Glycine hispida* (soy bean), vetches and *Hordeum murinum*. The adult, egg, and nymph are described. The observations on its life-history and habits have been carried out under widely differing conditions, Tempe, Ariz., being in a hot, semi-arid country with an annual rainfall of about 8 inches, while Greenwood, Miss., is warm and humid with an annual rainfall of nearly 50 inches. Under Arizona conditions, the combined lengths of the egg and nymphal stages varied with the temperature, from 35 to 114 days. In Mississipi a much shorter period was required,

the variation being from 26 to 37 days. On lucerne the egg is deposited beneath the epidermis through a long slit made in the stem by the female with her ovipositor. Usually only one egg is deposited through a single opening. The method of oviposition in cowpea stems is different from that in lucerne, the texture of the plant making possible the placing of a great many eggs in the stem through one opening. The seasonal history of *S. festina* varies with the climatic conditions, the minimum temperature of any particular year being especially important. The variation appears largely during the winter months, when the insect is supposed to be hibernating. In Arizona, during a mild winter, the insect does not hibernate at all in the adult stage. In that State hibernating adults, which emerge during the first part of February, oviposit at once and young of the first generation appear in March. There are three to four generations annually. The greatest number of individuals occurs during September, when adults of the third generation are appearing; early in November, the adults begin to disappear rapidly. Of the immense number that hibernate but few appear in the spring. This heavy mortality is doubtless due to the varying temperature, as the appearance of a week of warm days causes the insects to leave their shelters, and should the night temperature drop to freezing point, a great many succumb.

Damage to lucerne and other plants is due to the sucking of the plant juices by the nymphs and adults, causing the plant to wither. The worst damage is done by punctures in a regular and continuous line which girdle the stem. The nymphs are more responsible for this girdling than adults. In addition to the loss of plant juices, the stems are weakened, a gall usually develops, circulation is cut off, and a great many of the plants break off and die. The more tender stems are always chosen for attack. During cool weather feeding occurs closer to the ground than in warm weather. In the extreme heat of summer the shady side of the stem is frequented. To the casual observer the injury to the crop does not seem to be as heavy as it actually is, chiefly because nothing is seen to be devoured. Natural enemies do not exercise any appreciable control. A spider, *Argiope transversa*, Emerton, the harvester ant, *Pogonomyrmex barbatus*, Smith, and a small red predaceous mite, *Erythraeus* sp., are mentioned. *Agelaius phoeniceus sonoriensis* (the Sonoran redwing) feeds upon this insect. So far, no method has been found for entirely controlling the pest. Hopperdozers are inefficient; the timing of the removal of crops so as to destroy the eggs is useless, as many eggs are laid close to the ground; pasturing cannot be utilised. Clean methods of farming are the only measure that will bring about a considerable reduction of the insects. This will expose many individuals to their enemies and to cold. A bibliography of eleven works is given.

Cooley (R. A.). **Twelfth Annual Report of the State Entomologist of Montana**.—*Mta. Agric. Expt. Sta., Bozeman*, Bull. no. 102, December 1914, pp. 197–208. [Received 6th April 1915.]

During 1914, particularly in the early summer months, insect pests were unusually abundant in Montana. The outstanding feature was an unprecedented outbreak of *Phytometra* (*Autographa*) *californica*, Speyer (alfalfa looper), in nearly every part of the state. In the Bitter Root Valley inspectors report *Eriophyes pyri*, Pgst. (leaf blister mite),

as one of the worst fruit pests of the year. *E. padi*, Nal. (plum gall mite), distorted plum leaves in Eastern Montana ; spraying experiments for controlling plum diseases, carried on by the station botanists, incidentally demonstrated that this mite can be controlled by a thorough dormant spraying with lime-sulphur. Reports of damage by grasshoppers were fewer than for several years, but lucerne grown for seed suffered from them. The work of *Liothrips montanus*, Hood (currant thrips) [see this *Review*, Ser. A, ii, p. 380], has been noticed for several years. A predaceous bug, *Reduviolus ferus*, L., was several times observed feeding on the autumn migrants of *Pemphigus betae*, Doane (sugar-beet root-louse); irrigation, by keeping the soil continually moist, not only reduces the number of aphids, but increases both the tonnage and sugar content of the beets. In one locality maize and potatoes were seriously injured by the Jassid, *Oncometopia lateralis*, the insects being clustered about the stem of the plant. *Aphis brassicae*, L. (cabbage aphis), was very abundant, but *A. pomi*, De G., although common in all apple-growing sections of the State, was not so prevalent as in 1913. Although enormous numbers of the moths of *Phlyctaenodes* (*Loxostege*) *sticticalis*, L. (sugar-beet webworm), appeared in June, the injury was considerably less than for several years past. Numerous complaints of cutworms were received, and Eastern Montana suffered most, an invasion of *Euxoa* (*Chorizagrotis*) *agrestis*, Grote (army cutworm), in several instances destroying entire fields of grain and flax. *Pieris rapae*, L. (imported cabbage worm), was exceptionally abundant, and some injury was done by *Alsophila pometaria*, Harris (fall canker worm), which is apparently spreading. A particularly bad infestation of clothes-moths (*Tinea pellionella*, L.) was discovered in stored wool samples. Larvae were found in abundance and at work in February, although it is often stated that in the northern States they are not active during winter ; the wool was saved by a thorough fumigation with hydrocyanic-acid gas. The larvae of *Samia gloveri*, Strecker, were abundant on box-elder, elm, willow, etc. Maggots of fungus gnats belonging to the genus *Sciara* were reported as being extremely injurious to the roots of potted plants. *Hylemyia antiqua* (*Pegomyia ceparum*) (onion maggot) was reported from several localities, but in Bozeman was not as injurious as in 1913. Adults of *Tipula angustipennis* (smoky crane fly), were observed in great abundance during April and May. *Epochra canadensis*, Lw. (currant fruit-fly), continues to injure currants seriously ; experiments were conducted with a poisoned bait, but while the injury was considerably lessened, complete control was by no means effected. Data were obtained which indicate that *Pseudanthonomus validus*, Dietz (currant fruit weevil) [see this *Review*, Ser. A, ii, p. 380], is probably two-brooded. A large acreage of winter wheat presented a condition which for want of a better name was called "yellow wheat." In some cases wireworms were found upon the roots of affected plants, but a fungus was also present, and it is therefore difficult to decide the actual cause. Wireworms were also found injuring maize and potatoes. As a result of strict quarantine, the alfalfa weevil is not yet present in Montana. Attention is called to the need for an ordinance dealing with foul-brood in order that protection may be given to the bee industry in Montana, which annually produces about 1,000,000 lb. of honey.

JAKATA (A. A.). **Дополненія къ біологіи букарки.** [Additional data on the biology of *Rhynchites pauxillus*, Germ.]—**« Труды Естественно-Историческаго Музея Таврическаго Губернскаго Земства.»**—[*Memoirs of the Natural History Museum of the Zemstvo of the Govt. of Taurida*], *Simferopol*, iii, 1914, pp. 79–98.

This article gives the results of observations on the biology of *Rhynchites pauxillus*, Germ., conducted during 1912 and 1913, and forms a continuation of previous work on the same subject. With regard to the diapuse of the larvae, three series of experiments are described and summarised as follows :—The larvae only emerge from the leaves when these are destroyed by decomposition, and thus free them. The decomposition of the leaves is hastened by the amount of moisture, and therefore by accelerating decomposition the larvae may be made to issue sooner. Until the exit from the leaves the further development of the larvae is delayed and a state of diapuse arises. The larvae, which have passed from the leaves into the earth, remain in a state of diapuse, if the time of their exit is earlier than the normal one for pupation (in one experiment the larvae passed into the earth in April 1912, and remained there without pupating for four months). Generally speaking, the larvae remaining in a state of diapuse attempt to pupate and continue their metamorphosis at the normal times—viz., pupation at the end of summer and emergence of the imago in the autumn. The larvae from non-decomposed leaves, not subjected to moisture, are unable to get out of the leaves, being evidently unable to overcome with their mandibles the resistance of the undecomposed epidermis. This delays their development. If the leaves are moist, but not to such a degree as would result in decomposition, the larvae may remain in a state of diapuse for two years and more. Under conditions which produce the rapid and complete drying up of the leaves the larvae perish. The duration of the life of the larvae in the state of diapuse depends on the kind of tree, and they perished earlier in apple leaves than in those of pear, as the latter, owing to their impermeable cuticle, dry up more slowly. In Nature the state of diapuse has no need to last so long as under the artificial experimental conditions, and the ability of the larvae to remain in that state much longer than is required by the natural conditions of the Crimea tends to show that this adaptiveness has been acquired in some other country with longer dry seasons. Observations show that the parasite, *Bracon discoideus*, Wesm., winters in cocoons in the pupal stage, amidst fallen leaves, on or in the earth. The whole cycle of the development of the parasite is as follows :—The wintering generation appears at the end of May and oviposits in the first half of June ; its larvae and pupae are found in the middle of June, and a second generation appears at the end of that month. The larvae and pupae of that generation are found in the first half of July, and the majority of them remain over the winter ; a minority produces a third generation which is on the wing and oviposits in the middle of July, the larvae appearing at the end of that month and the pupae, which are found in the first half of August, remaining over the winter. In 1912 the author observed in one orchard near Simferopol a great mortality of the larvae of *R. pauxillus*, owing to the attacks of aphids on the leaves in which they were enclosed. The sucking of the leaves by the aphids deprived the larvae of their food, and both on apple and pear trees they perished in swarms.

NOTICES.

The Editor will be glad to receive prompt information as to the appearance of new pests, or of known pests in districts which have hitherto been free from them, and will welcome any suggestion the adoption of which would increase the usefulness of the Review.

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THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

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GOLOVIANKO (Z.). **Къ вопросу о видовыхъ и возрастныхъ признакахъ личинокъ** *Melolontha melolontha*, L. (*vulgaris*, F.) **и** *Melolontha hippocastani*, F. [On the question of the specific and age characters of the larvae of *Melolontha melolontha*, L. (*vulgaris*, F.) and *M. hippocastani*, F.]—**«Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xiv, nos. 2-3, 14th October 1914, pp. 243–253, 19 figs.

The structure of the mandibles of the larvae of *Melolontha melolontha* and *M. hippocastani* is described, the object being to establish, if possible, a method of distinguishing these larvae. It appears that the mandibles of the larvae of the two species immediately after moulting are absolutely indistinguishable; the jaws at that time differ greatly from those of the period before moulting; in the great majority of cases differences in the structure of the jaws could be observed in larvae found a long time after moulting or immediately before moulting or pupation, but this difference is thought to be due to the varying nature of the soil in which the larvae were found. As the larvae of *M. melolontha* usually occur in clay soil and those of *M. hippocastani* in sandy soil, these differences may be useful for the recognition of the species in some cases. The difference in the construction of the mandibles before and after moulting may serve as some indication of the age of the larvae in conjunction with the following data as to the sizes of the head of the larva of *M. hippocastani*: During the first year of the life of the larva the width of the larval head is 0·25 mm. and the height 0·15 mm.; during the second year of life the width of the head is 0·4 mm. and the height 0·25; during the third year the width is 0·65 and the height 0·4 mm. Figures are given illustrating details of the structure of the mandibles at different periods.

SMIRNOV (D.). **О методахъ борьбы съ вредными насѣкомыми.** [On the methods of control of insect-pests.]—**«Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xiv, nos. 2–3, 14th October 1914, pp. 332–337.

The methods for the control of insect pests may be divided into (1) direct destruction—*i.e.*, the poisoning or mechanical destruction of the pests; (2) indirect destruction—*i.e.*, by means of parasites, fungi and bacterial diseases; and (3) preventive remedies. The first type of remedy is the most in use at the present time, but is frequently very difficult of application and not always effective. It is often expensive in case of frequent outbreaks of pests of field crops and is sometimes harmful to plants. The remedies of the second group are still insufficiently studied. A more general use of various preventive remedies, which can be devised from the knowledge of the life-histories of various pests, is advocated, especially rotation of crops and various preventive devices such as trenches against *Hylobius abietis*, L., and caterpillars of *Euxoa segetum*, Schiff., etc. The selection of pest-proof strains of plants is especially advocated as affording a guarantee against frequent damage and not requiring the constant use of expensive appliances, materials and labour.

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Общіе выводы объ урожаѣ хлѣбовъ въ 1914 году. [General summary of the grain harvest in 1914.]—**« Извѣстія Глав. Управ. З. и З.»** [*Bulletin of the Central Board of Land Administration and Agriculture*], *Petrograd*, no. 40, 18th October 1914, pp. 957–963. [Received 30th April 1915.]

In European Russia the damage to field crops by various insect pests was not great during the past season. The Hessian fly (*Mayetiola destructor*) was reported as rather more numerous from Voronezh, Ekaterinoslav, Podolia, Saratov and on the Vistula, damaging mostly wheat and barley. The wheat chafer (*Anisoplia austriaca*) occurred in Kursk, Taurida, Ekaterinoslav and in the province of Don, but no great damage was suffered from it; single reports from the governments of Saratov, Samara, Tcheringov and Perm referred to the saw-fly, while thrips have damaged rye in the governments of Tula and Samara. Peas have suffered from aphids, *Haltica* and from a species of weevil. *Oria musculosa* was observed in some localities of the province of the Don and of Ekaterinoslav and ACRIDIIDAE in some districts of the government of Orenburg. Cabbage has been greatly injured by caterpillars and *Haltica*, while fruit trees were frequently attacked by *Cydia pomenella*, *Hyponomeuta malinellus* and *H. variabilis*. The chief pests of the governments of Western Siberia and Central Asia were ACRIDIIDAE, but they were noticed only over a limited area.

Ожидаемый урожай хлопка въ 1915 году. [The expected harvest of cotton in 1914.]—**« Извѣстія Глав. Управ. З. и З.»** [*Bulletin of the Central Board of Land Administration and Agriculture*], *Petrograd*, no. 41, 25th October 1914, pp. 990 991. [Received 30th April 1915.]

In the Trancaspian province cotton has scarcely suffered from insect pests except in the district of Merv, where some damage was experienced during the early period of growth. In Samarkand aphids and cutworms injured cotton in the early part of the season, while later red spider appeared, but no serious damage was done. From the province of Syr Daria, thrips and red spider were reported.

MAMONTOV (I. I.). **Библіографическій Указатель сочиненій и статей о болѣзняхъ и поврежденіяхъ культурныхъ растеній за 1911 годъ.** [Bibliographical Index of works and articles on diseases of and injuries to cultivated plants for 1911], *Petrograd*, 1914, 48 pp. [Received 12th May 1915.]

This index contains 601 titles of works and articles in Russian relating to diseases and pests of plants, accompanied in some cases by a short summary of the contents.

SERBINOV (I. L.). **Къ вопросу о главнѣйшихъ болѣзняхъ и вредителяхъ Астраханскаго и Камышинскаго края.** [On the question of the chief diseases and pests (of plants) in the govt. of Astrachan and district of Kamyshin (govt. of Saratov).]—**« Болѣзни растеній.»** [*Diseases of Plants*], *Petrograd*, viii, no. 6, 1914, pp. 155–174. [Received 7th May 1915.]

This is a report on the author's journey in 1912 in Astrachan and in the Kamyshin district of Saratov. In the latter district observati

were confined to the rodent, *Citellus* (*Spermophilus*) *guttatus*, T., and to the methods of controlling it. While in Astrachan various fungus and insect pests were investigated. The author mentions especially *Locusta* (*Pachytylus*) *migratoria*, L., *Calliptamus* (*Caloptenus*) *italicus*, L., and *Phlyctaenodes* (*Eurycreon*) *sticticalis*, against the last of which he urgently advises reploughing the fields in early spring. Further trials of *Coccobacillus acridiorum* against the locusts are also recommended.

SHTCHEGOLEV (I. M.). **Вредныя насѣкомыя и болѣзни растенiй, наблюдавшiяся въ Таврической губернiи въ теченiе 1914 года.** [Insect pests and diseases of plants noticed in the govt. of Taurida during 1914.]—**« Отчетъ о дѣятельности помощника Губернскаго энтомолога Таврическаго Земства за 1914 годъ.»** [*Report on the work of the Assistant Entomologist of the Zemstvo of the govt. of Taurida in 1914*], *Simferopol*, 1915, 19 pp.

The only remedy applied in the Crimea against *Rhynchites pauxillus*, Germ., consists in shaking them from the trees; *Anthonomus pomorum* has destroyed the harvest of apples in many orchards and has done considerable damage also to pears; removal of the damaged blossoms is practised against it; outbreaks of *Rhynchites bacchus*, L., occurred in the steppe orchards in the district of Melitopol; the sawfly, *Hoplocampa brevis*, Klug, has caused great damage round Alushta and along the River Katcha: remedies against it consist of shaking the insects from the trees and spraying the young buds with milk of lime; *Hoplocampa fulvicornis*, Klug, did serious damage to plum trees near Simferopol and in some other localities; APHIDIDAE were numerous, especially on standard trees; *Hyponomeuta malinellus*, Zell., although still numerous, loses its importance as a pest, being successfully combated. Great damage was caused by various species of COCCIDAE, to which serious attention will have to be paid.

The following pests of field crops are also reported: *Brachycolus noxius*, Mordw., did less damage than was expected in spring, owing to the vigorous state of the crop; experience has shown that late sowings suffer less from this aphis, and reploughing the barley stubbles and the plants growing from fallen grain is recommended. The seedlings of infested winter-sown crops should be destroyed and sheep grazed on them in spring, as rolling has proved ineffective. *Pentaphis trivialis* appeared on small areas, but disappeared in the middle of the summer. *Oria* (*Tapinostola*) *musculosa* did great damage in the neighbouring government of Ekaterinoslav, but appeared only in the district of Berdiansk in Taurida. *Lema melanopa* has increased during the last two or three years; powdering the affected plants with ashes and spraying with Paris green have been successful, while reploughing tends to destroy the larvae pupating in the soil.

VITKOVSKY (N.). **Мушка зеленоглазка.** [*Chlorops taeniopus*, Meig.—**« Южное Хозяйство.»** [*Southern Husbandry*], *Ekaterinoslav*, no. 24, 1914, pp. 850–855. [Received 28th April 1915.]

The larvae of *Chlorops taeniopus*, Meig., appear in May and beginning of June and injure the growing point of the stems of barley, thus preventing further growth and development. According to the

investigations of the Poltava Station, the loss caused by this fly amounts to 50 per cent. The larvae closely resemble those of *Oscinella* (*Oscinis*) *frit*, but with a microscope it may be observed that whereas the mandibles of the latter fly have five or six serrations, those of *Chlorops taeniopus* have as many as 16. The cocoons are found towards the end of June, the adults appearing about 28th June—*i.e.*, before the barley harvest. They live in the open until the germination of winter-sown crops, on which oviposition takes place, as well as on sprouted fallen grain. The eggs are mostly laid on the upper leaf of the plants and the emerging larvae devour the inner shoot and winter in the stem of the root; they pupate in spring and the resulting imagines oviposit on summer-sown grain, mostly barley, but also rye, wheat and less frequently oats; in the absence of crops, they breed on weeds. Owing to the hot and dry summers in that climate, they are unable to multiply on winter-sown crops, but in spring, before the hot weather has set in and moisture is sufficient, they are very destructive to summer-sown crops; in countries with a moderate and wet summer they are injurious both to summer and winter-sown crops. In Ekaterinoslav this pest is checked by a parasite of the larvae. The destruction of stubble by means of deep ploughing and scarifying; the destruction of weeds on the boundaries, roads, etc.; regular rotation of crops and black fallow; manuring and careful cultivation of the soil, enabling the plants to withstand the attack, are all recommended.

Отъ Курской Губернской Земской Управы. [From the Uprava (Executive) of the Zemstvo of the govt. of Kursk].

This circular announces the establishment of the Entomological Bureau of the Zemstvo of the government of Kursk, the objects of which include scientific research into the life-histories of local pests, the measures to be taken against them and the popularisation of knowledge amongst the agricultural population. The circular invites the public to report the occurrence of pests to the Bureau.

Vostrikov (P.). **Помидоры, какъ инсектисиды. Роль пасленовыхъ въ борьбѣ съ вредителями сельскаго хозяйства.** [Tomatoes as insecticides. The importance of Solanaceae in the control of pests of Agriculture.]—**« Хозяйство на Дону.»** [*Husbandry on the Don*], *Novotcherkassk*, x, no. 1, 31st January 1915, pp. 9–12.

Reference is made to the effects of tomatoes, when planted with cabbages, in protecting the latter from attack by *Pieris brassicae*. Observations were made in the province of Terek, where the planting of tomatoes always accompanies that of cabbages, and it is pointed out that the cabbages there are never attacked by *P. brassicae* and *P. rapae* or even by *Barathra* (*Mamestra*) *brassicae*, *Phyllotreta atra*, *P. nemorum*, *P. cruciferae* or *Plutella maculipennis* (*cruciferarum*); tomatoes are not, however, effective against *Aphis brassicae*. According to Vitkovsky, in the government of Volhynia the coarse tobacco known as "machorka" is sown round gooseberry bushes to protect them from *Sphaerotheca mors-uvae*. It is considered probable that other representatives of the family Solanaceae may possess the same valuable qualities.

The following abstracts are translated from **«Вѣстникъ Русской Прикладной Энтомологіи»** [*Messenger of Russian Applied Entomology*], *Kiev*, i, no. 5, 1915, by permission of the Editors.

PENGEROT (J.). **Бронзовка и синій свѣтъ.** [*Epicometis* and blue colours.]—**«Саратовскій Садоводъ.»** [*The Horticulturist of Saratov*], vii, 1914, no. 5, pp. 171–172.

Beetles of the genus *Epicometis* are found more frequently on rose-coloured hyacinths than on others, and never on blue ones. It is therefore thought that attempts to trap them on rose-coloured paper covered with an adhesive may be of some value. [See this *Review*, Ser. A, ii, pp. 44 and 374.]

DREIER (N.). **Кукурузный мотылекъ и борьба съ нимъ.** [*Pyrausta nubilalis* and the fight against it.] **«Константиноградскія С.-Х. Извѣстія.»** [*The Konstantinograd Agricultural Bulletins*, i, 1914, no. 6, pp. 5–8.]

Pyrausta nubilalis (*Botys silacealis*) is yearly spreading more and more in the district of Konstantinograd, Poltava, side by side with the increase in the area under maize. The same is also the case in the neighbouring government of Ekaterinoslav. The maize damaged by the caterpillars in 1908 amounted to 20 per cent. and gradually increased in the following years, standing at over 90 per cent. since 1912. The remedies recommended are the destruction of maize stems in April by burning or using them as food for cattle, and spraying with Paris green or other insecticide during the hatching of the caterpillars.

LAVRENKO (A. N.). **Зезія или стеклянница осиновая и мѣры борьбы съ ней.** [*Trochilium apiforme* and measures against it.]—**«Хозяйство на Дону.»** [*Husbandry on the Don*], xi, 1914, no. 25, pp. 483–484.]

Aspen and poplar trees have greatly suffered in the province of the Don and in the adjoining governments from the attacks of *Trochilium apiforme*. Smearing the trunks with lime or clay and cow dung or the collection of the pupae and moths are recommended as remedies.

POMERANTZEV (D. V.). **Сельскохозяйственное значеніе грача въ Велико-Анадольскомъ и Маріупольскомъ лѣсничествахъ Екатеринославской губерніи.** [The agricultural importance of rooks in the Veliko-Anadol and Mariupol Forestries of the govt. of Ekaterinoslav.] **«Матеріалы къ познанію русскаго охотничьяго дѣла.» Изд. Деп. Землед.** [*Materials towards a knowledge of Russian hunting*]. *Dept. of Agriculture, Petrograd*, vi, 1914, 58 pp.

In order to investigate the agricultural importance of rooks 120 stomachs of this bird of all ages and at all seasons of the year were dissected. Insect pests and their larvae occurred in the stomachs to the extent of 55 per cent. to 76 per cent. Among the insect pests found were: COLEOPTERA: *Silpha atrata*, *S. obscura*, *Agriotes* sp., *Ludius* sp., *Epicometis* (*Tropinota*) *hirta*, Poda, *Pentodon idiota*, Hbst., *Amphimallus* (*Rhizotrogus*) *solstitialis*, L., *Rhizotrogus aestivus*, Ol.

R. aequinoctialis, Hbst., *Lethrus apterus*, Lax., *Anisoplia austriaca*, Hbst., *Phylax* (*Dendarus*) *punctatus*, Serv., *Opatrum sabulosum*, L., *Psalidium maxillosum*, F., *Bothynoderes* (*Cleonus*) *punctiventris*, Germ., *B. foveicollis*, Gebl., *Mecaspis alternans*, Hbst., *Cyphocleonus tigrinus*, Panz., *Otiorrhynchus ligustici*, L., *Lixus* sp., *Dorcadion equestre*, Lax.; the Pentatomid bugs, *Aelia acuminata*, L., *A. rostrata*, Bch., and *Palomena prasina*, L.; TIPULIDAE and a species of *Agrotis*. It is therefore concluded that rooks are very useful in the district investigated, and deserve protection.

RODD (E.). **Размноженіе на соснѣ дровосѣка** *Monochamus* **въ дачахъ Алтайскаго округа.** [The multiplication of *Monochamus* on pines in the woods of the Altai district.]—**«Лѣсной Журналъ.»** [*Forestry Journal*], xliv, 1914, nos. 6–7, pp. 1048–1064.

This article on the beetles of the genus *Monochamus* gives only such observations as are at variance with those described by Pomerantzev (Biological Observations on Tree-eating Insects near the Town of Velsk, Government of Vologda, in 1901 and 1902 (*Forestry Journal*, 1907, No. 10)). In the steppe woods of the Altai districts three species are widely distributed—viz., *Monochamus sutor*, L., *M. galloprovincialis*, Ol., and *M. quadrimaculatus*, Mots. (In a note the writer of the abstract says that in the mountains of Altai a fourth species, *M. saltuarius*, Gebl., may be taken, and possibly two more, *M. impluviatus*, Mots., and *M. guttatus*, Bles., occur.) In the absence of firs, all the species breed successfully on pines. The duration of the generations does not always last two years. The author hardly ever observed burrows parallel to the axis of the trunk, as recorded by Pomerantzev. With few exceptions, they were made perpendicular to the axis. The differences in the direction of the burrows is explained by the fact that the observations of Pomerantzev refer to windfallen timber, while these observations refer exclusively to burned woods, attacked when the trees were still standing. *Monochamus* only attacks dead timber, most of the dead trees in the Altai district resulting from forest fires. The large number of dead trees has resulted in a great increase of *Monochamus*, and in one small area 73½ per cent. were infested. The infested trees are sold as fuel and not as timber, which greatly decreases their value. The effects of the larvae of *Monochamus* in transforming timber into fuel have caused damage to the local timber industry amounting to at least £8,000. The chief enemies of the larvae are woodpeckers, especially *Picus martius*. Removal of damaged trees is not considered practicable. A better measure is the early felling of the trees damaged by the fires, especially by the spring and summer ones, and the removal of their bark without delay, so as to prevent oviposition and to destroy the eggs already laid underneath the bark and the emerged larvae. The larvae frequently survive as much as three months in water in floating trees, the only consequence being a delay in their development. In these cases the one-yearly generation is transformed into a two-yearly one.

SCHREIBER (A. F.). **Борьба съ личинками майскихъ хрущей на капустныхъ грядахъ.** [The control of larvae of *Melolontha* in cabbage beds.]—**« Вѣстникъ Садоводства, Плодоводства и Огородничества.»** [*Messenger of Gardening, Fruitgrowing and Market-Gardening*], 1914, nos. 8–9. pp. 665–666.

The author reports on the testing of two remedies against the larvae of *Melolontha*: First, of the remedy of Mr. Dengink—viz., 1 lb. of soap, 3 lb. of tar and 10 lb. of soot in 27 gallons of water; and secondly, of the remedy recommended by K. N. Rossikov—viz., 2 lb. of Paris green in 108 gallons of water. The tests took place near Irkutsk on cabbage beds swarming with *Melolontha* larvae. With the first liquid the cabbages were watered every alternate day, but the larvae suffered no ill effects. When the beds were watered with Paris green the results were excellent, the majority of the larvae being destroyed. This remedy can, however, only be successfully applied if the larvae are not deeper than about 4 inches beneath the surface of the soil. Another recently described remedy against these larvae, which consists of watering the infested soil with a solution of carbolineum (three table-spoons in 27 gallons of water), was not tested.

SCHREINER (J. F.). **Къ вопросу о вредителяхъ табака.** [On the question of pests of tobacco.]—**« Сельскій Хозяинъ.»** [*The Rural Landowner*], 1914, no. 38, pp. 2142-2144.

The following pests of tobacco are reported: *Gryllotalpa*, against which the usual remedies are recommended, and *Euxoa* (*Agrotis*) *obesa*, the caterpillars of which are destroyed by means of poisoned paste.

CHOLODKOVSKY (N. A.). [**Observations on *Chermes* spp. in Switzerland.**]—**« Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xiv, no. 2–3, 14th October 1914, pp. lxxix–lxxxiii.

At a meeting of the Russian Entomological Society held on 6th April 1914, a communication was read by Professor N. A. Cholodkovsky on his observations on *Chermes* in Switzerland. At Meiringen, he observed *C. viridis*, Ratz., which lives on firs, migrating to larch trees (*Larix europaea*) and notes that the opening of the galls of this species takes place there a month earlier than in northern Russia, where it occurs at the end of July. The existence of an early green brood laying dark green eggs, and a late, yellow one, laying yellowish green eggs, turning gradually dark green, is confirmed. In Meiringen, the migration of the winged forms of *C. abietis*, Kalt., on to larch trees from firs was observed, whereas later on, in August, in Engelberg, owing to the absence of larches individuals emerging from the opening galls oviposited on the same firs, frequently in close proximity to the galls from which they had just issued. Observations on *C. sibiricus*, Chol., in St. Moritz, show that the galls of this species are formed, not by the egg-laying stem-mothers, but by their descendants. The woods at Schoenewerd were found infested with the silver fir *Chermes*. This species causes first the young shoots, and then the ends of the branches and the tops to wither, young trees being entirely

destroyed. Older trees do not suffer much from it. According to M. Huber-Zeller, this species is playing havoc in the cantons of Soloturn, Aarau and Neuchatel, where a large number of young silver firs had to be cut down. This *Chermes* proved not to be *C. piceae*, Ratz., but a nearly allied species, *Chermes nüsslini*, Börner, which has been studied by Nüsslin and still more fully by Marchal. According to Nüsslin, this species lives only on silver fir (*Abies pectinata*) and although it sometimes produces winged sexuparae in spring, which migrate to firs (*Picea excelsa*) and produce sexual forms, this never leads to the development of the fecundated egg and to the formation of a gall next year: thus the migration of this species is rudimentary and resembles that previously observed by the author in *Chermes pini*, Koch, in the Russian forests. Marchal has however shown that *C. nüsslini* can have a successful migration and a full cycle, including the development of galls, provided that the migration is not to the European fir, but to the Caucasian (*Picea orientalis*). The galls, which are fully described and figured by Marchal, appear to be similar in form to the slightly larger ones collected on *Picea orientalis* and sent to the author from Caucasia in 1896. They also much resemble the galls of *C. pectinatae*, Chol., (*C. coccineus*, Chol.), which migrates to various species of silver firs. The Caucasian galls were identified by the author, on account of the structure of the antennae of the winged forms which emerged from them, as *C. funitectus*, Dreyfus. Since Marchal described the whole cycle of development of *C. nüsslini*, there is no doubt that we have here an original southern species, which in Western Europe is represented by a variety that has lost its migratory habit and developed an exclusively parthenogenetic mode of reproduction. The wintering stem-mother (fundatrix vera) of this species is now known, and it is significant that in Switzerland the skin of it is identical in structure with that of the intermediate stem-mother (fundatrix spuria), hibernating on silver fir. As no other species occurring on the needles of silver firs have been discovered in Western Europe, and as the description of *C. funitectus* is also applicable to *C. nüsslini*, it is concluded that *C. funitectus* is identical with *Ch. nüsslini* and that the name *C. funitectus* must have priority.

In S. Moritz, *C. viridulus* was also found beneath the bark of larch trees.

FINŢESCU (G. N.). **L'*Yponomeuta malinella* (Zeller) en Romanie.** [*Hyponomeuta malinellus* in Rumania.]—*Bull. Section Sci. Acad. Roumaine, Bucharest*, iii, no. 3, 12th October 1914, pp. 99–102. [Received 28th April 1915.]

Hyponomeuta malinellus occurs throughout Rumania, causing serious injury to the apple orchards. The winter is passed in the egg or larval stage within the nest and there is more than one generation during the summer. Several parasites control this species to a great extent, including the Ichneumons, *Campoplex sordidus*, *Herpestomus* (*Ichneumon*) *brunnicornis*, *Labrorychus* (*Anomalon*) *tenuicornis*, the Tachinid *Prosopaea fugax*, Rond. (*Erythocera pomoriorum*), and the Hemipteron, *Capsus mali*. Against the larvae, the insecticide "Truffaut" was very satisfactory.

FINŢESCU (G. N.). Contributions à la biologie de l'hémiptère *Capsus mali*, Meyer, (syn. *Capsus magnicornis*, Fallen, *Phytocoris magnicornis*, Macq., *Atractotomus mali*, Fieber, *Capsus plenicornis*.) [Contributions to the biology of the hemipteron *Capsus mali*, Meyer, etc.] *Bull. Section Sci. Acad. Roumaine, Bucharest*, iii, no. 4, 15th November 1914, pp. 132-140, 4 figs. [Received 28th April 1915.]

Capsus mali, which preys on the larvae of *Hyponomeuta malinellus*, is described in its various stages. It is concluded that the larvae of *Hyponomeuta* are not absolutely essential to the bug during the early stages of its existence, since the liquid secreted by the female *Aphis mali* can also serve as food. The host becomes necessary as soon as the nymph stage is reached by the bug; the nymph and adult live entirely at the expense of the larvae and pupae of the moth.

COVENTRY (E.). Report on the Progress of Agriculture in India for 1913-14; *Calcutta*, 1915, pp. 95, 2 plates.

In the entomological section, investigation into the life-histories of injurious and other insects was continued. Special attention was paid to pests of wheat, rice, sugar-cane, cotton and stored grain. Observations have been made on the parasites and hyperparasites of the cotton bollworms. The passing of the Destructive Insects and Pests Act has been important in controlling the importation into British India of living plants which may introduce noxious insects as they have done in the past. An attempt has been made to work out methods of insect control by examining and taking advantage of the reactions of insects to particular stimuli which seem to influence to a large extent their more important activities. In Mysore, important work has been carried on in connection with *Coccus viridis* (*Lecanium viride*), a recently introduced pest of coffee. This insect causes great injury and in some localities has destroyed entire bushes and caused the abandonment of the estates.

THOMPSON (W. R.). Sur une Tachinaire parasite à stade intracuticulaire. [Note on the intracuticular stage of a Tachinid parasite.] —*C. R. de l'Acad. des Sciences, Paris*, clx, no. 2, 11th Jan. 1915, pp. 83-86, 2 figs.

Noctuid larvae, gathered from bushes of *Haematis virginiana*, were found to be infested with a Tachinid parasite belonging to the Echinomyiinae. The parasites were in an early larval stage and were found between the two layers of the cuticle of the host. This intracuticular phase seems to be normal and characteristic of the life-cycle, the parasite probably remaining throughout the winter in this position.

GREEN (E. E.). Some Remarks on the Coccid genus *Leucaspis* with Descriptions of Two New Species.—*Trans. Entom. Soc., London*, pts. iii and iv, 27th February 1915, pp. 459-467, 2 plates.

Notes on the genus *Leucaspis* are given, and two new species described, *L. perezi*, sp. n., from *Pinus halepensis* and *P. canariensis*, from Teneriffe, Canary Islands, and *L. salicis*, sp. n., on stems, branches and twigs of *Salix* sp. from Beluchistan.

HARRISON (J. W. H.). **Coccidae observed in Durham and North Yorkshire.**—*Naturalist, London*, no. 697, February 1915, pp. 78–81.

Oak-feeding species were scarce, *Aspidiotus zonatus*, Frauenf., being once taken. Specimens of *Aspidiotus perniciosus*, Comst., were once observed on a pear in the Greenmarket, Newcastle-on-Tyne. *Parlatoria pergandii*, Comst., is stated to occur frequently on imported oranges. *Chionaspis salicis*, L., is the most abundant Coccid, occurring commonly in the Birtley district, on alder, ash and sallow (*Salix caprea* and *S. cinerea*), and on ash and *Salix aurita* near Middlesbrough. It is particularly destructive to *S. cinerea* on Waldridge Fell, where the weakened trees soon fall victims to the weevil, *Cryptorhynchus lapathi*, L. *Lepidosaphes ulmi*, L., (*Mytilaspis pomorum*, Bouché), is recorded from apple at Low Fell. *Phenacoccus aceris*, Sign., was scarce, being noted once only in small numbers on blackthorn at Chester-le-Street.

PEARSON (A. H.). **Home Correspondence: Winter Spraying.**—*Gardeners' Chron., London*, lvii, no. 1470, 27th February 1915, p. 115.

Fruit-tree growers are warned against spraying trees with alkali wash in consecutive years. In the author's experience, this is liable to cause the bark to harden and the trees either become stunted, or if they expand, their bark cracks. It is suggested that this practice accounts for the present increase of canker. Washes containing paraffin are said to have a similar effect in desiccating the bark, but lime-sulphur is stated to have always given good results as a winter-wash.

TULLGREN (A.). **Senapsbaggen** (*Phaedon cochleariae*, **Fabr.**) **jämte några andra skadedjur på pepparrot och deras bekämpande.** [The mustard beetle, *Phaedon cochleariae*, F., and other injurious insects of the horse radish and their control.]—*Meddelande no. 113 från Centralanstalten för Försök på Jordbruksområdet, Stockholm*, Entom. Avdeln. no. 22, 1915, 15 pp., 4 figs.

Of late years the ravages of *Phaedon cochleariae* in the neighbourhood of Enköping, the chief centre of horse-radish cultivation in Sweden, have increased considerably and threaten to ruin this industry completely. In 1913, the loss caused by this insect in the area belonging to the town alone, amounted to about £833. The author in 1913 and 1914 studied the life-history of this and other insect pests of horse-radish, and in 1914 experiments were conducted in order to control them. The beetles hibernate and appear in early spring, ovipositing in the middle of June. At the end of this month young larvae appear, and in about three weeks they are full-grown, the pupation period being about a fortnight. The new generation of beetles appears at the beginning of August, the succeeding generation being adult at the end of September.

The original host plants of the mustard beetles are probably wild species of *Nasturtium*, *Cardamine* and *Cochlearia*, but it has also been recorded from a plant belonging to another family, *Veronica beccabunga*. It also attacks turnips and cabbage. The eggs are laid exclusively on the under side of the leaves, generally singly, in small pockets made

by the ovipositor of the female. The larvae are very sluggish, but the beetles, on the contrary, are very active. At Enköping, one-year old plants of horse-radish were the most injured, and it was noticed that the attack began at the edges of the fields and from this spread towards the centre, which seems to imply that the beetles have their winter quarters in the vegetation on the edge of the ditches.

In the autumn of 1913, experiments with contact sprays, such as lysol, tobacco extract and lime-sulphur were made, but failed to give any positive results. In the following year, only arsenic sprays were used, Paris green (2 grms. of green to 4 grms. of lime per litre water) and arsenate of lead (3 to 6 grms. per litre water) with an addition of 0·2 grms. gelatine, according to the formula given by Vermorel and Dantony. These sprays were quite effective. Other control measures include, collecting and destroying early in the autumn all waste and rubbish, in order to minimise the hibernating quarters. The edges of ditches should also be free from vegetation. As soon as the beetles appear, the plants should be sprayed with Paris green or arsenate of lead (the use of the latter is not yet allowed in Sweden, but the Royal Pomological Society has applied to the Government for permission to use this poison for combating insect pests). During the investigations, other injurious insects found on horse-radish were:—*Plutella maculipennis*, Curt., *Pieris rapae*, L., and *Pionea forficalis*, L. The arsenic sprays also proved effective against these.

Tomei (B.). **La Pasta Caffaro alla prova nel circondario di Urbino.** [Tests of Pasta Caffaro in the Circondario of Urbino.]—*L'Agricoltura Moderna, Milan*, no. 3, 1st & 15th February 1914, 18 pp. [Reprint received 15th May 1915.]

Pasta Caffaro is a copper oxychloride and lime combination now largely used in Italy against *Phytophthora* and also for general purposes. The analysis given shows that it contains 16·5 per cent. copper, 8·39 per cent. calcium, 17·5 per cent. chlorine, and 3·60 per cent. of oxygen in combination, and the makers guarantee the copper content to within 3 per cent. The usual strength for spraying is 1 per cent. in water. It is reported to be at least as good as Bordeaux mixture, to be simple and easy of use, not expensive and to adhere well; the objections to it are a tendency to stick to the bottom of the container and to foul the spray pumps, and also that it is not easy, especially at a little distance, to distinguish sprayed from unsprayed plants; the manufacturers have now remedied these defects. The results of trials in vineyards are given in detail and the claims of the manufacturers appear to be more or less justified.

Gray (G. P.). **New Fumigating Machines.**—*Mthly Bull. Cal. State Commiss. Hortic., Sacramento*, iv, no. 2, February 1915, pp. 68–80.

There are two systems of fumigation with hydrocyanic acid. In one case the plants to be fumigated are enclosed in a tent or other covering and the gas generated by pouring sulphuric acid on to potassium cyanide in vessels within the tent. This method, though rough and ready, has proved effective, but it is believed that some of the damage occasionally done is directly due to the method, in that the chemical

reaction under the conditions is not quite so simple as supposed, for ammonia is produced and a good deal of wet, acid spray distributed over the plants and also on the tents, which suffered considerably. The second method may be called the external, and consists in the use of a special generator outside the space to be fumigated, the gas being conveyed by a hose. Special generating machines are described in this article, with reports on the results of their use, and it is claimed that there is a great saving of time and greater uniformity and efficiency, while no damage is done to the tents and there is also a great saving of labour and less risk. Improvements in construction will however be necessary, as there is a good deal of corrosion of working parts ; but the method is regarded as having great advantages over the pot system.

Branigan (E. J.). *Vedalia vs. Icerya* **on Pears.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* iv, no. 2, February 1915, pp. 107–108, 2 figs.

During the past two years there have been frequent complaints of serious damage to pears by *Icerya purchasi* (the cottony cushion scale), and for some reason the Coccinellid, *Novius* (*Vedalia*) *cardinalis*, which was supplied to growers, did not readily attack the scale when breeding upon pears. During 1914, the problem became so serious as to threaten the pear industry in certain localities. The black smut from the honeydew made it necessary to go to the great expense of washing the fruit, and this is not only costly but reduces its quality. Recently the author, being in the infested locality, investigated this apparent aversion of *Novius* for *Icerya* on pears. The explanation appears to be due to the constant spraying of the pears for codling moth with arsenate of lead, which saturates the young scales and egg-masses with the poison and is fatal to both larval and adult *Novius*. This prevents their control of scale on pears, while they control the scale in the same vicinity when on plants other than pear trees. In the laboratory, some *Novius* were confined on unsprayed scale-infested pear and citrus twigs, and these fed quite as readily upon the pear-infesting scale as on the citrus ones. *Novius* cannot therefore be used as a control against the scale on pear trees, but as pears cannot be successfully grown without spraying for codling moth, *I. purchasi* must therefore be controlled by some artificial means. Neither spraying nor fumigation has as yet proved sufficiently effective against it. Perhaps *Lestophonus* and *Ophelosia*, the two internal parasites of *Icerya*, may prove of value in this instance.

Insect Notes.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* iv, no. 2, February 1915, p. 116.

The adults of *Diabrotica soror*, Lec. (western twelve-spotted cucumber beetle) were seen in great numbers hibernating among the dry weeds along a levee in Yolo County, in January 1915. *Lygus pratensis* (tarnished plant bug) was common in the same place. *Aphis avenae* (European grain aphis) is threatening barley. During the summer, considerable damage was done to the leaves of bay trees by *Trioza alacris* (laurel Psylla) ; in November, when some of the worst infested

places were examined, only a few winged forms were present, where earlier in the season the damage from the larvae had been serious. It would therefore appear that this pest winters in the adult stage. *Chrysomphalus dictyospermi* was found on palms in a greenhouse. *Isaria* fungus is controlling *Saissetia oleae*, Bern., to a considerable extent. *Dialeurodes citri* (citrus white fly) has again made its appearance, but as a large percentage of larvae were killed in experiments with oil emulsions, complete control is anticipated. *Leptomastix* sp., the new parasite from Italy of the citrus mealy bug [*Pseudococcus citri*], was colonised during January.

FERNALD (H. T.). **Some Present Needs in Economic Entomology.** *Jl. Econ. Entom., Concord,* viii, no. 1, February 1915, pp. 30–40.

This is the annual address of the President of the American Association of Economic Entomologists and consists of a survey of the general position of, as well as of the needs of Economic Entomology, at the present time. These include the more complete and accurate study of subjects already more or less known, as well as the investigation of new ones. The continued study of the gipsy moth has probably doubled our knowledge of this insect and its habits. There is however still much more to be known and there is, generally, great need for complete and exhaustive studies of the life-histories of even common insect pests, as well as of those which may become so. When *Heterocampa guttivitta*, Walk., suddenly became destructive in the U.S.A. some years ago, practically no information regarding the insect was available. Much research is needed in connection with insecticides and especially into the causes of the damage done by them to the trees sprayed. A case is cited of two peach orchards, one in Northern Ohio and the other in Virginia, which were sprayed on the same day with the same material at the same strength, and, so far as could be determined, under precisely similar conditions; one was severely injured and the other escaped. No explanation was forthcoming, but a case of this kind serves to emphasise the necessity for a critical study of all the factors concerned in spraying. The introduction of parasites is likely to prove an increasingly important method of attacking pests, but the work should be conducted only by the most competent persons. Much further knowledge of the effects of temperature and food conditions upon insects is needed, in order to clear up questions connected with reproduction and longevity, and a careful study of climate in relation to pest outbreaks, combined with better knowledge of the life-histories, may in future enable useful warnings to be issued and the outbreaks forestalled. More accurate knowledge of the distribution of insect pests or possible pests is required, and the reasons for any real or apparent spread must be sought for. The great difficulty of preventing the importation of pests is referred to and the author says that, in his opinion, the time will come when, in spite of laws and inspections, the pests from one country will become the pests of all others, except where climate, lack of food and other natural conditions operate to prevent it.

Ruggles (A. G.). **Life-History of *Oberea tripunctata*, Swed.**—*Jl. Econ. Entom., Concord*, viii, no. 1, February 1915, pp. 79–85, 6 figs.

In June 1911, a new pest was found on the elm trees in Minnesota, causing the destruction of the leaves on the terminal twigs. The insect was at first believed to be *Oberea ulmicola*, Chittenden, but adults reared from the eggs were identified as *O. tripunctata*. This species was recorded by Forbes on elm and in 1911 on dogwood, but until the time of these observations was not previously known in Minnesota. The eggs are inserted under the edge of the bark by the ovipositor, many twigs being completely girdled. The larvae hatch in June and burrow into the wood, passing the winter in the tunnels so formed. The pupal stage is reached in May of the second year and the adult emerges in two or three weeks. Many larvae perished in the burrow towards the cut end of the twig, possibly owing to some parasite. Removal of infected twigs or proper pruning seemed to be effective in controlling the insects.

Felt (E. P.). **Fumigation for the Box Leaf-Miner.** -*Jl. Econ. Entom., Concord*, viii, no. 1, February 1915, pp. 94–96.

The box leaf-miner, *Monarthropalpus buxi*, Lab., causes the shedding of the leaves of the infested plants. The adults appear in the latter part of May and there is but one generation annually. Experiments have been made to ascertain the possibility of destroying the larvae while still in the mines. Twigs were exposed to the action of various gases: 30 drops of carbon bisulphide with an exposure of three and one-half hours caused the death of the larva, while the foliage was uninjured. As the result of a series of tests, it was concluded that exposure to the vapour of two teaspoonfuls of carbon bisulphide in a ten-quart bell-jar for at least one, preferably two hours, was most effective. Similar tests with carbon tetrachloride had no effect on the larvae. C. P. ammonia was fatal to them, but had also an injurious effect on the leaves, especially when large quantities were used. It is possible that small amounts would destroy the larvae without any serious injury to the plants. Flake naphthalene at the rate of one-half teaspoonful to a two-quart jar with an exposure of 5 hours caused the larvae to become quiescent, but they eventually recovered; there was no injury to the plant. With potassium cyanide, some larvae were killed, while the plant was uninjured. Contact sprays produced no results, owing to the thickness of the membrane over the mine. During the discussion, H. T. Fernald expressed the opinion that it was impracticable to apply fumigation methods, because of the conditions under which the box is grown. The effect of poison sprays on larvae or adults has not yet been determined.

Gillette (C. P.) & Bragg (L. C.). **Notes on some Colorado aphids having alternate food habits.**—*Jl. Econ. Entom., Concord*, viii, no. 1, February 1915, pp. 97–103.

Chermes cooleyi, Gillette, and var. *coweni*, Gillette, live throughout the year on the Engelmann and blue spruces in one form, and the Douglas fir in the other. The lice, at the time of observation, were

in the first instar; those on the spruce had their setae thrust into the bark of the twigs where, later, eggs would be deposited and would hatch out as the second generation. The galls formed by the second generation give rise to the adult, winged lice, which migrate to the Douglas fir to oviposit. The young from these eggs remain on the needles until the next spring, when they become mature. Some of the individuals from the eggs then laid remain upon the fir, while others migrate to the Engelmann and blue spruces, where they give rise to the stage which remains over the winter. There is thus a migration each year of the two forms of this species; the Douglas fir should therefore not be planted near Engelmann or blue spruces. *Pemphigus betae*, Doane, a native of the Rocky Mountain region, feeds especially on sugar-beets, garden beets and mangel-wurzels, also on the roots of *Aster*, *Solidago*, *Iva xanthifolia* and *Chenopodium*. During September and October, about one half of the individuals acquire wings, leave their summer hosts and migrate to the cottonwoods. Sexual forms appear early in the autumn, while larvae forming galls on the under side of the cotton leaves have been observed by A. C. Maxson and called *Pemphigus balsamiferae*. This gall has also been referred to *P. populicaulis*, Fitch, but the latter seems to be confined to the Middle and Eastern States, while *P. betae* is strictly a Western species. A list of species of *Pemphigus* with their hosts, is given. *Thecabius populiconduplifolius*, Cowen, has *Populus occidentalis* for its winter and early summer host and migrates to a species of *Ranunculus* in late summer and autumn. Some individuals do not leave the latter host in autumn and may be found on it all the year round. *Prociphilus corrugatans* occurs upon *Crataegus* as a winter host; *P. alnifoliae*, Williams, is found on *Amelanchier alnifolia* in winter; *Colopha ulmicola*, Fitch, has *Ulmus americana* as winter host and *Eragrostis* during summer and autumn; *Tetraneura graminis*, Monell, which lives on *Ulmus americana* in winter, migrates to *Lersia oryzoides* in summer. *Eriosoma* (*Schizoneura*) *americana* appears in its sexual form in September round the trunks of American elms; the eggs laid by the sexual forms hatch in the following spring, causing the leaf-curl gall. The alternate food-plant of the spring migrants is as yet unknown. *E. rileyi* differs from other members of the genus owing to the fact that there is probably no alternate host. *E. crataegi*, Oestlund, is a bark feeder, occurring on roots and branches of *Crataegus* in Colorado; the second host is unknown. *E. lanigerum* inhabits the apple throughout the year; sexual forms migrate in August and September, but the second host is not definitely known. *Anoecia corni* is found in the egg stage in winter on the stems of *Cornus stolonifera*. *Rhopalosiphum rhois* is common on *Rhus trilobata* as a winter host; in summer and autumn it is found on wheat, oats, barley and *Elymus*. *R. lactucae* is found on *Sonchus oleraceus* in summer; in September, males and sexuparae migrate to *Ribes aureum* or *R. vulgare*, where sexual females are deposited. The summer form of *R. hippophaes* inhabits species of *Persicaria*; in autumn, migration to *Elaeagnus*, *Shepherdia* and *Hippophae*, takes place. *R. pastinacae*, found on Umbelliferae in summer, must be distinguished from *R. capreae*, also on Umbelliferae; the former species migrates to *Lonicera* or *Xylosteum*, the latter to a species of willow. *Hyalopterus arundinis*, occurring on plum and prune as over-winter hosts, migrates to *Phragmites*

communis in early summer; males and sexuparae return to *Prunus* in the autumn. *Aphis bakeri* winters on apple and *Crataegus*; early in summer it migrates to the red and white clovers. *A. setariae* is found most commonly on *Panicum crusgalli* in summer, in winter on the plum. *Myzus bragii* seems to have other summer hosts besides *Carduus arvensis*; *M. persicae*, after passing the winter on peach, plum, or cherry, migrates to a wide range of hosts, including cruciferous plants, potatoes, tomatoes, beets, *Rumex*. *Phorodon humili* winters on the plum, and may sometimes be found upon plum foliage throughout the year; the regular summer host is the hop. *Macrosiphum granaria* and *M. dirhodum* both occur on the rose as a winter host, and migrate to grain and grasses in summer.

Blakeslee (E. B.). **A mechanical protector for preventing injury by the Peach Borer.** (*Abstract*).—*Jl. Econ. Entom., Concord*, viii, no. 1, February 1915, pp. 103–107.

The habits of the newly-hatched larvae of the peach-borer (*Aegeria exitiosa*) are discussed. In addition to the fact that many eggs are deposited in the crown of the tree, larvae hatching from eggs deposited on the trunk and branches migrate downwards and begin their work below the surface of the soil. When a barrier is placed at the crown of the tree, the larvae do not attempt to enter above it. By the use of a cone-shaped, tarred-paper protector, extending out for 8 inches from the base of the tree, and sealed with a viscous substance, it is possible to exclude the larvae entirely. The protectors are cut out in a circular form with a hole, in the middle slightly larger than the trunks. To support the protector, the earth is made into a small mound, the base of which is slightly below and the top slightly above the surface of the ground. The protectors are fastened tightly round the tree, the place of contact with the tree and the overlapping parts being coated with an adhesive sealing material, and the earth pulled back over the edges. Experiments have shown that these protectors are able to maintain their impenetrable character in the field. No cement or gas-tar mixtures are used to harden the soil, for fear of injuring the trees. In discussing the paper, Mr. E. G. Titus said that in Utah the borers attacked trunks and branches as well as the crown of the tree, thus rendering the use of a mechanical protection difficult. Mr. Newell also stated that in Texas paper protectors had not proved successful. Mr. Scott gave an account of his experiments for the control of the borer. He at first tried numerous washes, but without success; then, taking advantage of the habit of the larva of crawling down the trunk, he devised a method of preventing it from entering the soil. He adopted a tarred felt mat, 16 inches in diameter, with a hole in the middle equal in diameter to that of the tree, and a slit from the hole to the outer edge. The soil was first moulded round the tree, then the protector placed on the mound, its slit edges glued together, and the whole sealed to the tree with a viscous material. All openings were completely filled up, so that it was impossible for the borers to reach the soil without crawling away from the tree beyond the edge of the protector. The best sealing material was a residuum from the partial distillation of coal tar. Results were perfect where the mats had been properly secured to the trees. Mr. Blakeslee found tanglefoot the best

sealing material, but Mr. Headlee, using the same preparation, found that the bark of the trees died beneath it. Mr. W. E. Rumsey, experimenting in West Virginia, sprayed the young borers with Avenarius carbolineum emulsion and also "Orchard Brand" miscible oil. The soil was removed from the base of the tree and the trunk sprayed from 6–8 inches above the general surface to the bottom of the cavity formed; the soil was then replaced. The sprays were applied in October and the trees examined in the following June. The control trees showed an average of 5 borers to a tree; with the miscible oil, the average was one per tree, with the carbolineum emulsion less than one per tree. The spray had therefore penetrated the bark, without causing any apparent injury to the tree.

DEAN (G. A.) & NABOURS (R. K.). **A New Air-Conditioning Apparatus.**—*Jl. Econ. Entom., Concord,* viii, no. 1, February 1915, pp. 107–111, 2 pls., 6 charts.

This is a description of an apparatus for the control of moisture and temperature on a large scale, in supplying air under constant and regular conditions to incubators and breeding chambers for zoological work. The total cost of the apparatus including the breeding chamber and installation is about £350.

HOWARD (L. O.). U.S. Bur. Entom. **Notes on the Progress of Economic Entomology.**—*Jl. Econ. Entom., Concord,* viii, no. 1, February 1915, pp. 113–119.

From the time when General W. G. Le Duc took office as United States Commissioner of Agriculture in 1877, the expansion of the Department has been remarkable. It has now become the greatest research organisation in the world; every State has its agricultural experiment station and almost all have an agricultural college giving instruction in general and economic entomology. The founding of state experiment stations and the introduction of various plant pests have been responsible for a great increase in the number of working entomologists and the realisation of the importance of the work. Excellent teaching is being carried on at all the colleges. In its international aspects, economic entomology is rapidly developing. The Association of Economic Entomologists has elected to its membership official entomologists of foreign countries, thus bringing about a universal exchange of publications. The Imperial Bureau of Entomology of Great Britain has founded a series of scholarships in economic entomology. The passing of the Federal Horticultural Law in 1912 has brought America into relation with the plant inspection services of other countries. A Congress at Rome, in 1914, attempted to harmonise laws and bring about a uniform system among the different countries. The work of the past few years has increased the belief that the most thorough biological study of every injurious form is necessary. The tendency to break up the science of economic entomology into "phytopathology," in so far as insects affect plant life, and "parasitology," where insects directly affect men and animals, seems one which should be avoided. It is also obvious that plant pathology and economic entomology are unrelated in their basic

principles. Their successful study requires workers with absolutely different training and wholly different technique. To combine them into one service would be impracticable, except as units of a large agricultural institution. Questions relating to the damage done by insects to man and domestic animals are best handled by the economic entomologists familiar with the whole range of entomological activity. The term "economic entomology" seems more likely to take a firmer hold in Europe than does the term "phytopathology," in this significance, to gain ground in America; this will mean that internationally the term "economic entomology," as applying to the whole field, will be generally adopted. That branch of the science relating to the carriage of disease by insects is best carried on by trained entomologists, and it is in this field that we must perhaps look for the greatest advances in coming years.

Weiss (H. B.). **Some recent insect importations into New Jersey.**—*Jl. Econ. Entom., Concord*, viii, no. 1, February 1915, pp. 133–135.

Scale-insects are the pests most frequently imported, the chief being *Coccus hesperidum*, L., occurring on bay trees from Belgium, *Chrysomphalus dictyospermi*, Morg., on palms from Belgium, *Hemichionaspis aspidistrae*, Sign., on *Aspidistra* and ferns from Belgium, *Diaspis boisduvalii* on orchids from England, *Chrysomphalus* (*Targionia*) *biformis*, Ckll., on orchids from Venezuela, *Pseudaonidia paeoniae*, Ckll., on azaleas from Japan, and *Aulacaspis* (*Diaspis*) *pentagona*, Targ., on peach stock from Japan. Except in the case of greenhouse species, all infested plants were destroyed. In 1914, a species of ant, *Iridomyrmex humilis*, Mayr, was found on roses imported from Germany; this is an Argentine species and has been a pest in the Southern States and California. It has recently been introduced into South Africa and Portugal. In April 1914, the Calandrid, *Eucactophagus graphipterus*, was found in an orchid house at Summit, N.J. This weevil is a native of Costa Rica. *Ulex europea* from England was found infested by *Apion ulicis*, a weevil injurious to seeds. An injurious imported beetle, *Myelophilus piniperda*, L., was discovered attacking Scotch fir, boring out the tips of the central shoots, causing the tree to assume a crooked branching habit; this type of injury resembles that of the white-pine weevil. *Agrilus viridis*, another imported beetle, attacked roses in New Jersey. The larva bores spiral channels in the sap-wood over which a gall forms. Cutting and burning the infected stems during autumn or winter, seems the best method of control. *Callopistria floridensis*, the Florida fern caterpillar, was found during September 1914 injuring greenhouse ferns. Up to the present it has yielded successfully only to handpicking, supplemented by trapping the moths. The most serious discovery was that of the eggs of *Lymantria* (*Porthetria*) *dispar*, L., and later the capture of an adult male. The infestation occurred on evergreens used for show purposes and was at least two years old. Eggs of mantis are not infrequently imported from Japan. *Damaster blaptoides*, a large black Carabid, has been taken from Japanese azaleas. *Pterostichus* (*Feronia*) *vulgaris*, L., another beneficial Carabid, has been found on plants from Holland and *Amara polita* on others from England. The latter lives on decaying vegetable matter and is

therefore beneficial. Other injurious species which have become established are whiteflies on azaleas from Belgium, ants from Holland and France, *Pseudococcus* sp. on palms and bay trees from Belgium, Tingitids on rhododendrons from Holland, and *Orgyia* (*Notolophus*) *antiqua* also from Holland.

DAVIS (J. J.). **Cages and Methods of studying underground Insects.**—*Jl. Econ. Entom., Concord*, viii, no. 1, February 1915, pp. 135–139, 12 figs.

The best methods of breeding underground insects were determined from a study of the life-history of *Lachnosterna* and related forms. Coleopterous larvae with a three-year life-cycle were bred in several different kinds of cages, descriptions and figures of which are given. The most satisfactory and cheapest of these were ordinary red flower pots, 12, 15 and 16 inches respectively in diameter and depth. Large rectangular cages 5 by 8 feet and 2½ feet below ground and 2½ feet above, constructed of metal and wooden frames covered with 18-mesh pearl wire cloth, were useful as checks on the smaller cages. Usually several species of the same genus were placed in each of the large cages. The pots were filled with soil which had been sifted to remove insects, and sown with a mixture of timothy and blue grass. Pieces of old maize stalks were included, since young grubs of *Lachnosterna*, *Cyclocephala*, etc., feed on decaying vegetation, and for larvae which were partially or wholly scavengers, manure was added. Pots thus prepared were buried almost to the top in the soil and covered with cylinder-shaped tops. Beetles, preferably pairs collected in copula, were introduced, foliage, if necessary, being supplied. Fresh seed and water had to be given as required. During winter the covers were replaced by straw, or straw and manure, to a depth of one foot; this was advisable as the larvae could not go down to their normal depth for hibernation. The above cages were examined once or twice a year to obtain specimens of different ages. For obtaining eggs and records of individual pairs, standard size pots with finely sifted soil were used; they were covered with wire screen tops within which single pairs were placed. The soil was not sown nor were the pots sunk in the ground, but foliage was supplied and a record kept of the amount eaten by the beetles. The cages were sifted every few days, using a 16 mesh sieve; if the soil were sufficiently moist, small balls of earth containing the eggs remained intact. The eggs were then placed in boxes of soil, moistened when necessary, and kept in a cool place comparable with natural conditions. To study the habits, growth, moults, etc. of the larvae, one ounce tin ointment boxes were used; a grain or two of wheat was added to these. Older larvae were fed on grains of maize and examined once a week. For convenience, 60 or 70 tin boxes were fitted into a tray. When the hibernation period approached, all grain was removed and the soil moistened; the tins were then either left in the trays or placed in boxes and buried to a depth of one to two feet.

The moults, length of instars, etc. of the army worm, *Cirphis* (*Heliophila*) *unipuncta*, were successfully ascertained; in this case control experiments were made to determine whether or not the tin boxes produced unnatural conditions for the larvae. A. A. Girault, from

experiments on rearing Scarabaeid larvae, concluded that the underground Tower cages made of wire gauze were the most satisfactory. It appears, however, to be agreed that the kind of cage matters little, provided the larvae receive good attention.

Chapman (J. W.) & Glaser (R. W.). **A preliminary list of insects which have Wilt, with a comparative study of their Polyhedra.**—*Jl. Econ. Entom., Concord,* February 1915, pp. 140–147, 14 figs

The clinical aspects of "Wilt" are very similar in all the species studied; the disease is characterised by the formation in the bodies of infected caterpillars of polyhedra-shaped, highly refractive, angular bodies, which have their origin in the nuclei of the tracheal matrix, hypodermal cells, fat cells and blood corpuscles. When death results, they make up a great part of the saponified body tissues. Wilt first appears in a chronic form, as conditions become more unfavourable it becomes acute, and finally ends in a general epidemic. A consideration of both external characteristics and the polyhedra is essential to a complete diagnosis of isolated or chronic cases, because it can be easily confused with fungus, protozoan or bacterial diseases. For purposes of discussion, insects have been divided into three groups; group *A* contains, with the exception of the silk-worm, the insects studied by the authors; group *B* contains a list reported by the European investigators Prowazek, Escherich, Wahl, etc.; group *C* is made up of insects found in U.S.A. which have a disease resembling wilt in many of its clinical aspects. There is a striking similarity in shape between the polyhedra of the different species of caterpillars given in group *A*, including the Gipsy Moth, Apple Tent Caterpillar, Army Worm, Tussock Moth, Oak and Range caterpillars. The report of European investigators on a disease of the Nun Moth and silkworm caterpillars is lacking in detail, but enough is given to show that the observers were not dealing with true polyhedral disease. The species in group *C* are all of more or less economic importance; the various observers who have worked on the life-histories and habits of these pests have made special mention of these maladies and their possible importance as factors in controlling the insects. The polyhedra in the same individual and in different species vary greatly in size. This difference tends to strengthen the view that the polyhedra are reaction bodies.

Felt (E. P.). *Mycodiplosis macgregori,* **n. sp.**—*Jl. Econ. Entom., Concord,* viii, no. 1, February 1915, p 149.

The new midge described was bred by Mr. E. A. Macgregor from red spider on cotton; it is readily separable from *M. tsugae*, Felt, by differences in the antennae and male genitalia.

Aldrich (J. M.). *U.S. Bur. Entom.* **A new *Sarcophaga* parasitic on *Allorhina nitida*.**—*Jl. Econ. Entom., Concord,* viii, no. 1, February 1915, pp. 151–152. 1 fig.

Sarcophaga utilis, sp. n., a parasite of *Allorrhina nitida*, is described.

FELT (E. P.). **Scurfy Scale on Norway Maple** (*Leucaspis japonica*, **Ckll.**) —*Jl. Econ. Entom., Concord*, viii, no. 1, February 1915, p. 160.

Twigs of maple and privet are recorded as severely infested by *Leucaspis japonica*, numbers of this rare scale being present on the leaves, chiefly at the base of the principal veins.

BRITTON (W. E.). **The Gypsy-Moth.**—*Conn. Agric. Expt. Sta., New Haven, Conn.*, Bull. no. 186, February 1915, 24 pp., 16 figs.

This paper is intended for general information regarding *Lymantria* (*Porthetria*) *dispar*, L., (the gipsy moth), its distribution, injury, control, etc. A useful diagram showing the life-cycle of the insect is given.

WATSON (J. R.). **New Thysanoptera from Florida.**—*Entom. News, Philadelphia*, xxvi, no. 2, February 1915, pp. 49–52, 1 plate.

The following new thrips from Florida are described :- *Cryptothrips pini* amongst the needles of pine trees ; *Heterothrips aesculi* from blossoms of *Aesculus pavia* ; and *Euthrips tritici* var. *projectus*, var. n., a common form in Florida, found in flowers of orange, tomato, roses, begonia, numerous composites, and among the needles of tall pine trees. *Cryptothrips floridensis* [see this *Review*, Ser. A, ii, p. 597] has been received from Ceylon.

RUST (E. W.). **Three New Species of** *Aphelinus*.—*Entom. News, Philadelphia*, xxvi, no. 2, February 1915, pp. 73–77.

Three new Hymenopterous parasites are described :—*Aphelinus capitis* (male unknown) reared from *Aspidiotus hederae* on ivy (*Hedera helix*), from *A. hederae* and *A. rapax* (*camelliae*) on oleander (*Nerium oleander*), from *Aspidiotus* sp. on *Pinus radiata*, from *Chionaspis pinifoliae* on *Pinus radiata*, and from *Diaspis* (*Aulacaspis*) *zamiae* on *Cycas revoluta*, all in California ; *Aphelinus quaylei* (male unknown) from *Selenaspidus* (*Pseudaonidia*) *articulatus*, *Hemichionaspis minor* and *Aspidiotus rapax* on various hosts in Peru, and from *Chrysomphalus aurantii* and *C. aurantii citrinus* on citrus trees in California ; and *Aphelinus limonus* (male unknown) from *Hemichionaspis minor* on pigeon-pea in Hawaii.

SEVERIN (H. H. P.). **Experiments in Destroying Fruit Infested with Fruit-Fly Maggots.**—*Entom. News, Philadelphia*, xxvi, no. 2, February 1915, pp. 78–83, 2 tables, 1 fig.

The author discusses his own experiments, in which both *Ceratitis capitata* and *Dacus cucurbitae* were used, as well as the investigations of other writers on the same subject. Since burying infested fruit in over three feet of loose soil requires a considerable amount of labour, if Mally's method of burying beneath ten inches of soil carefully trampled down will prevent the flies from escaping, it will not only be a cheap and practical method of destruction, but will also be a means of adding a valuable fertiliser to the soil. Submerging fruit in water for four days would be quite effective, provided it were collected daily.

The two methods could be advantageously combined; infested fruit could be collected daily and thrown into a tank of water, and when a sufficient amount has accumulated, it could be buried. This would do away with the daily ploughing or digging of trenches, filling in, and tramping of the soil, but in large orchards, the daily gathering of infested fruit would be rather expensive on account of the labour involved.

GIRAULT (A. A.). **Some Chalcidoid Hymenoptera from North Queensland.**—*Canadian Entomologist, London, Ont.*, xlvii, no. 2, February 1915, pp. 42–48.

The following new species are described, each from a single female; the genera *Eurydinotomorpha* and *Erotolepsiella* also being new: *Elasmus margiscutellum* and *E. orientalis* (ELASMIDAE); *Chalcitelloides nigrithorax* (CHALCIDIDAE); *Agaon nigriventre* (AGAONIDAE); *Eurydinotomorpha pax* (PTEROMALIDAE); *Erotolepsiella bifasciata* (MISCOGASTERIDAE); and *Neomegastigmus collaris*, *N. petiolatus*, *Philotrypesis longiventris* and *Sycoscaptella angela* (CALLIMOMIDAE).

CAESAR (L.). **Deformed Apples and the Causes.**—*Canadian Entomologist, London, Ont.*, xlvii, no. 2, February 1915, pp. 49–54, 4 figs.

This popular article briefly examines the causes of apple deformation, the chief insects implicated being the plum curculio [*Conotrachelus nenuphar*], apple curculio [*Anthonomus quadrigibbus*], the apple maggot or railroad worm [*Rhagoletis pomonella*], leaf-rollers, green fruit-worms, aphids and the Capsids, *Heterocordylus malinus*, *Lygidea mendax*, *Neurocolpus nubilus*, *Paracalocoris colon* and *Lygus invitus*.

Spray mixtures, especially Bordeaux, sometimes injure a part of the epidermis of the young fruit, and if the injury be sufficiently deep, interrupt the growth of that side and so cause deformity.

CAESAR (L.). **An Imported Red Spider attacking Fruit Trees.**—*Canadian Entomologist, London, Ont.*, xlvii, no. 2, February 1915, pp. 57–58, 2 figs.

The author had for some time suspected that the red spider so common on fruit trees in Ontario was not *Tetranychus bimaculatus*, and when, in September 1912, specimens were sent to the U.S. Bureau of Entomology, they were determined as *T. pilosus*. This is a European species, which attacks fruit trees, and its relationship to *T. mytilaspidis*, which feeds chiefly on oranges, is very close, if they are not identical. Besides the anatomical and colour differences, which are given, *T. pilosus* differs from *T. bimaculatus* in that it passes the winter as an egg, deposited in the axils of the twigs and branches, while *T. bimaculatus* winters as an adult in the ground or in sheltered hiding places. The latter species feeds largely on the lower surface of the leaf beneath a fine silken web in or under the protection of which it lays its eggs; *T. pilosus* feeds and oviposits on both surfaces, and makes no web, but fastens its eggs by a few fine silken threads to the leaf or twig in which they are laid. European plums are by far the favourite host plants of *T. pilosus*, apples being next and then sour cherries. Peaches

and Japanese plums are very little infested, while hawthorns in a few, apparently exceptional, cases have been severely attacked. The foliage of badly infested trees becomes covered with numerous fine whitish blotches, very noticeable on the upper surface, which after a time turn brown. *T. pilosus* has been found in most of the fruit districts of Ontario; that it has not been recorded before appears to have been due to its close resemblance to the common *T. bimaculatus*.

JACK (R. W.). **Some Injurious Caterpillars.**—*Rhodesia Agric. Jl., Salisbury*, xii, no. 1, February 1915, pp. 43–57, 3 plates.

Laphygma exempta, the swarming caterpillar, is a native of Africa, and appears periodically. It was abundant in Umtali and Salisbury in 1910; in April 1914, it was again observed at the Experiment Station, Salisbury. In December 1914, serious damage to maize crops was reported from Hartley, Mazoe, and Makoni districts. The life-history has not been fully investigated. The eggs are laid in clumps of about 60 on the food-plant; the caterpillars feed rapidly, and having attained their full growth in a few weeks, enter the soil to pupate. The adult emerges in two or three weeks and lays eggs for the next generation. The natural food-plants are various grasses, and this is the reason why the species is not usually in evidence, except when it swarms from the veld on to the cultivated lands. It has been recorded on maize, kaffir corn, millet, oats, barley and wheat, and occasionally on potatoes. The causes which lead to seasons of great abundance are imperfectly understood, but can be summed up as the concurrence of a number of favourable factors. The most active checks are parasites, insectivorous birds and insects. Small numbers of a parasitic Tachinid have been bred from this species. Parasitic wasps play a similar part, and the white stork, *Ciconia alba*, kills great numbers when the insect is abundant. Invasions are so rapid that prompt measures are necessary; the grass between the swarm and the crop may be sprayed with poisoned sugar solution, consisting of:—arsenite of soda, 1 lb.; black sugar, 8 lb.; water, 10 gals. Live-stock must be kept off the treated veld. Where the caterpillars develop on the crop itself, nothing can be done if they are evenly distributed, as maize and small cereals will not bear the cost of spraying. If an intense attack occurs on a limited area, it is best to spray with arsenite of lime, adding 3 lb. of black sugar to each 50 gals. of water.

Laphygma exigua, the pigweed caterpillar, has been found in great abundance on the pigweed, *Amaranthus paniculatus*. This moth is less restricted than the preceding in regard to its food-plants. The eggs are laid in clumps on the food-plants. The caterpillars, which hatch out in four days, feed rapidly, enter the soil in 18 days to pupate, and emerge as adults 12 days later. Several generations follow each other rapidly. In America, this species is said to pass the winter as an imago; in Rhodesia, moths emerge at least until late in June and eggs are laid as early as September. The food-plants are lucerne, potato, tobacco, swede, maize, spinach and mangold; in the Transvaal it has been reported on cotton, in the United States on pea, apple, pear, onions and sugar-beet. As a pest in Southern Rhodesia, it is chiefly connected with early potatoes grown in October and mangolds in February and March. The best remedy is spraying with arsenical

wash; 3 lb. of lead arsenate to 50 gals. of water is best, but most expensive; $\frac{1}{4}$ lb. arsenite of soda, 2 lb. quick or fresh water-slaked lime, to 50 gals. water has proved effective. The Paris green spray, consisting of 1 lb. Paris green, 2 lb. fresh lime and 160 gals. water, yields a heavy precipitate and settles quickly. When lucerne is attacked, green stuff dipped in poisoned sugar solution strewn between the rows has been found effective.

The maize caterpillar, *Cirphis loreyi*, is related to the "army worm," *Cirphis unipuncta*, of America and India and occurs as a pest of maize in Rhodesia. The eggs are laid in strings within the leaf sheaths of maize or grasses. The caterpillar feeds, probably at night, on the young leaves of the heart. By day most of the larvae seem to conceal themselves in the earth at the foot of the plant. Pupation takes place in the soil; the life-cycle is short, and a number of broods occur during the year. The natural food-plants are wild grasses, especially *Eleusine indica* and *Setaria verticillata*, both of which occur on rich soil suitable for maize culture. Serious injury has resulted upon the cultivation of such land. The development is slow during the winter, larvae collected in June having produced adults in August, the intervening period being passed in the pupal stage. The facts mentioned concerning the origin of serious attacks indicate that weeds must be kept down in the maize fields from the beginning of cultivation. If the grass has been allowed to grow, an inspection should be made for caterpillars in the earth at bases of the plants. If many are present, it is better to wait for about 10 days until some have pupated before cultivating. The damage would not be serious enough to call for remedial measures; if the "army worm" habit is developed, remedies similar to those used for the "swarming caterpillar" are applicable.

Prodenia litura, the tomato caterpillar, has been recorded as a pest in Africa and India. The eggs are laid in clusters on the leaves, being covered with buff-coloured hairs from the body of the female moth. The larvae hatch in 3–4 days, pupate 20 days later in the soil and the adult emerges after about six days. The caterpillar is a general feeder, having been recorded on tomato, potato, pea, tobacco, maize, castor oil plant, etc. The larva, when hiding beneath the food-plant during the day, may be collected by hand and destroyed. Plants badly infested may be sprayed with one of the arsenicals used for pigweed caterpillar or dusted when the leaves are wet with a mixture of 1 lb. Paris green and 20 lb. of lime.

The only important pest of tobacco is *Chloridea obsoleta*, the tobacco budworm; the same insect also attacks tomato fruit and, in America, cotton bolls. The eggs, which are attached singly to the food-plants, hatch in 3–5 days. The larvae reach maturity in 2–3 weeks and enter the soil to pupate, the adult emerging two weeks later. This moth remains in the pupal stage in the winter. The range of food-plants, as indicated above, is considerable and this species has also been found on linseed, cowpeas and ground-nuts. As a pest of tobacco, it has not been found in Rhodesia feeding on the unopened buds, but the young leaves in the centre of the plant have been attacked. The most injurious brood is that which hatches out in February; later broods attack the seed-capsules, causing only minor damage. As the pupa passes the winter near the surface of the soil, the most practical measure

is to plough deeply in June the land on which the last brood has fed, and to harrow thoroughly so as to break up the pupal cells and expose the pupae to the cold. When on the tobacco, a practical method is to apply the mixture of dry Paris green and lime given above, to the centre leaves of each plant.

Phytometra (*Plusia*) *orichalcea*, the burnished brass moth, is apt to be destructive in the kitchen garden and frequently in the field. There are a number of broods during the year. The pupal stage, lasting from 9–10 days, is passed in a cocoon on the food-plant. The latter may be lucerne, Egyptian clover, maize, rape, radish, carrot, lettuce, potato, and "black-jack" (*Bidens pilosa*). Severe outbreaks are generally checked by disease, Tachinid flies and the white stork. Spraying with arsenical compounds to which resin soap has been added is effective. The soap is prepared by boiling 2 lb. powdered resin with 1 lb. washing soda in half a gallon of water until a clear solution is obtained; this quantity is mixed with 25 gals. of the spraying fluid. Edible plants should not be sprayed within three weeks of the time when they are required for use.

RICHARDS (P. B.). **Methods and Materials for the Control of Insect Pests (Part 3).**—*Agric. Bull. Fed. Malay States, Kuala Lumpur*, iii, no. 5, February 1915, pp. 208–214.

Arsenite of soda is a most effective stomach poison in dealing with young locusts or army worm caterpillars. A solution consisting of 1 lb. arsenite of soda, 5 gals. water, and 1½ lb. molasses, should be sprayed in early morning on grass around or in front of the direction in which the swarm is travelling. Arsenious oxide is used in poison baits for surface caterpillars and mole-crickets. A suitable mixture consists of 2 lb. sugar, 1 lb. white arsenic, 6 lb. bran and water to make into a stiff paste. Lead compounds form valuable insecticides, but are poisonous to cattle. Lead chromate is used at a strength varying from 1 lb. to 30–60 gals. of water; the foliage is not injured in any way. Red lead forms a good dusting powder for young crops. Carbon compounds, such as naphthalene, nicotine, extracts of quassia and hellebore, are used in the preparation of contact sprays. Naphthalene in the form of an emulsion can be prepared by mixing a saturated solution of naphthalene in kerosene with a hot solution of soft soap. The stock solution is diluted before use. The emulsion forms a suitable spray for vegetables intended for immediate use, but has no value as a general insecticide.

WATERHOUSE (C. O.). **Descriptions of Two New Genera and New Species of Mymaridae from Tasmania.**—*Trans. Entom. Soc., London*, pts. iii and iv, 27th February 1915, pp. 536–539, 1 plate.

Selenacus turneri, gen et sp. n., *Palaconeura turneri*, gen. et sp. n., *P. interrupta*, sp. n., *P. canescens*, sp. n. all from Mount Wellington, Tasmania, are described. These species may, perhaps, be associated with some Homopterous galls which were very abundant where they were taken.

LITTLER (F. M.). **Woolly Aphis.**—*Weekly Courier, Launceston, Tasmania*, 18th February 1915. [Reprint received 3rd May 1915.]

The only effective method of dealing with *Eriosoma lanigerum* is by spraying. "Blackleaf 40" is an ideal spray, but is expensive. Aphids of chrysanthemum, rose and carrot were killed immediately by it in the test experiments. Pure benzine or kerosene are satisfactory, but kerosene emulsion does not affect a large proportion of the adult females. The work is best undertaken in autumn and spring; in autumn, a large proportion of females can be killed, which would otherwise hibernate at the roots of the trees; in spring, females that have hibernated can be destroyed. A good painting mixture is the best to use, that recommended by the author having proved most successful. [See this *Review*, Ser. A, ii, p. 604.] Factors liable to be overlooked include the number of females which hibernate not only at the roots of apple, but also at the roots of trees as yet undetermined, and during the spring, winged females fly from tree to tree, infesting those which are clean.

NICHOLLS (H. M.). **The Pear Mite.**—*Agric. Gaz. Tasmania, Hobart*, xxiii, no. 2, February 1915, pp. 50–53, 2 figs.

Eriophyes pyri, the pear mite, causes serious injury to young pear orchards by burrowing into the leaves of the trees. The mites hibernate in the buds, and several generations are produced in one season. In Australia, the species is confined to pear trees, but in America it has been recorded on apple, white beam, mountain ash and cotoneaster. One of the most effective methods of dealing with young trees in early stages of infestation is hand-picking and burning the leaves so removed. Great care should be exercised in the selection of nursery stock. On large trees, the best method is to spray in autumn, when the leaves are falling. Kerosene emulsion or lime and sulphur solution are effective; the latter should be used at the rate of 1 gal. of commercial solution to 25–35 gals. of water. Spraying in spring or pruning infected shoots is useful. *Eriophyes pyri* is kept in check to some extent by a larger mite, *Seius pomi*.

PESCOTT (E. E.). **Orchard and Garden Notes.**—*Jl. Dept. Agric., Victoria, Melbourne*, xiii, no. 2, 10th February 1915, pp. 124–126.

Citrus and other evergreen trees attacked by scale-insects may be sprayed with resin compound, crude petroleum emulsion, or lime-sulphur mixture. The most effective method is fumigation; the trees are enclosed in a tent to prevent the escape of gas, and exposed for about three-quarters of an hour to hydrocyanic acid gas generated from potassium cyanide and sulphuric acid. Fumigation should be carried out at night time or on a cloudy day and the foliage must be thoroughly dry. Young deciduous fruit trees attacked by woolly aphis or *Bryobia* mites should be sprayed with nicotine solution or resin wash after the crop has been gathered. If the pest is not serious, spraying may be left until the winter, when red oil emulsion or lime-sulphur can be used.

FULLAWAY (D. T.). **Report of the Entomologist.** —*Rept. Hawaii Agric. Expt. Sta., 1914, Washington, D.C.*, 20th February 1915, pp. 43–50.

The three principal pests of crucifers in Hawaii are the imported cabbage worm, *Pieris* (*Pontia*) *rapae*, the cabbage webworm, *Hellula undalis*, and the diamond backed cabbage moth, *Plutella maculipennis*; the cabbage aphids, *Aphis brassicae* and *Myzus persicae*, are also very injurious. The serpentine leaf-miner [*Agromyza pusilla*], cutworms, grasshoppers and thrips, are of minor importance. *P. rapae* is a serious pest of cabbage grown under field conditions. It was first noticed in Hawaii in 1898. The time to deal with these caterpillars is before they are half-grown; if the plants can be started in frames under partial cover, so that the butterfly is unable to oviposit on them, they have a good chance of beginning to produce heads with little or no infection. Arsenic sprays are recommended (arsenate of lead or Paris green and lime), applied on both sides of the leaf. The Tachinid, *Frontina archippivora*, undoubtedly does much to check the larvae; *Chalcis obscurata* has been bred from the pupa while a bacterial disease is common in this species.

Hellula undalis is equally injurious to cabbage and related crops. This pest was introduced into Hawaii between 1892 and 1895. The larvae frequently destroy seedlings, older plants becoming stunted or deformed. According to H. O. Marsh, screening the seed beds and clean culture are the best remedies. The Braconid, *Chelonus blackburni*, is a common parasite of this species.

Plutella maculipennis was an early introduction into Hawaii. The damage to the plants results from the destruction of the leaves by the larvae. Arsenic, kerosene emulsion, and hot-water sprays are recommended against it. Multiplication is checked by the Ichneumon, *Limnerium blackburni*. The above three species are confined to crucifers; *P. rapae* attacks turnips and cauliflower in addition to cabbage; the larva of *P. maculipennis* is most injurious to thin-leaved plants and seedlings; *H. undalis* damages root crops, such as radishes and turnips, by eating out the bud, and destroys the foliage of thin-leaved plants.

Among other pests of crucifers in Hawaii, is the Aphid, *Myzus persicae*, which is more common than *Aphis brassicae*. Both species are generally controlled by a Braconid, *Aphidius* (*Diaeretus*) *rapae*, but the peculiar weather conditions in Hawaii sometimes favour the rapid multiplication of these pests. Such infestations may be remedied by spraying with whale-oil soap (1 lb. to 5 U.S. gals. of water), blackleaf 40 (1 fluid oz. with 3 oz. of whale-oil soap and 4 gals. of water), or miscible oils.

Agromyza pusilla attacks thin-leaved crucifers, such as turnips, but is of no great importance as a crop pest. The same insect under different names has been found in geranium, nasturtium and beet, in addition to many other cruciferous and leguminous plants. This pest is checked by Hymenopterous parasites belonging to the genera *Derostenus*, *Diaulinus*, and *Chrysocharis*. Several species of thrips are common, especially the onion thrips, *Thrips tabaci*. Cutworms, including *Agrotis ypsilon*, *A. crinigera*, and *Laphygma* (*Caradrina*) *exigua*, *Zinckenia* (*Hymenia*) *fascialis*, *Phytometra* (*Plusia*) *chalcites*, as well as the grasshopper, *Atractomorpha crenaticeps*, have been

reported as attacking succulent plants. These are usually controlled by parasites, but otherwise can be checked by arsenic sprays. The melon fly, *Bactrocera* (*Dacus*) *cucurbitae*, has been reported infesting cabbage, but this is thought to have been due to abnormal conditions in the plant. The absence of clean cultivation is one of the principal sources of trouble in growing cruciferous crops. When the crops are gathered, the stumps and rubbish should also be disposed of. Burning or burying several feet deep would give better results than deep ploughing. This measure is almost essential in dealing with insects which breed throughout the year.

EHRHORN (E. M.) & FULLAWAY (D. T.). **Report of the Division of Entomology.**—*Hawaiian Forester and Agriculturalist, Honolulu*, xii, no. 2, February 1915, pp. 46–49.

Since 1st January 1915, citrus nursery stock has not been allowed to be imported into the United States or its territories from foreign countries, owing to the dangerous disease known as Citrus Canker. Two packages of mistletoe imported from California into Hawaii were fumigated on account of infection with *Aspidiotus rapax*, the greedy scale. Sunflower seed from Portugal was found to contain the larva of a Tortricid moth. The following parasites have been bred and liberated :—*Diachasma fullawayi*, *D. tryoni*, *Tetrastichus giffardii*, *Spalangia* sp., *Opius humilis*, and *Galesus* sp. The conspicuous feature of the work on parasites was the retardation in development due to low temperatures for a certain period ; no harm resulted from this. Observations showed that the *Spalangia* brought from West Africa was a true fruit-fly parasite, but its slow development rendered it impossible to secure numbers large enough to warrant liberation in the open.

TRYON (H.). **Nut Grass-destroying Coccid and its Mitigation.**—*Queensland Agric. Jl., Brisbane*, N.S. iii, no. 2, February 1915, p. 72.

The author discountenances the use of the so-called "Mealy Bug" *Antonina purpurea australis* for destroying nut-grass in view of the fact that all described species of *Antonina* are associated with Gramінaceae, including sugar-cane, maize, wheat and other cereals. He has further found this insect associated with buffalo grass and with one of the native Graminaceae.

JARVIS (E.). **The Sugar-cane Bud Moth,** *Loxostoma* **sp., Fam. Tineidae.**—*Queensland Agric. Jl., Brisbane*, N.S. iii, no. 2, February 1915, pp. 72–76, 1 pl.

Although of little economic importance, a Tineid belonging to the genus *Opogona* (*Loxostoma*) occasionally proves injurious to seed cane, the caterpillars sometimes destroying as much as 80 per cent. of the eyes in soft varieties like "Clark's Seedling." This moth is probably related to *Ereunetis flavistriata*, Wlsm., which is said to occur commonly at times throughout Hawaiian cane-fields, and to occasion a good deal of loss by destroying the buds of soft varieties desired for

cuttings. In addition to direct injuries of this nature, the caterpillars feed on the leaf-sheath, gnaw the surface of the rind close to the buds, and frequently bore into cane-stalks, thus producing wounds favourable to fungus diseases. Owing to their secluded habits and the insignificant size of both larva and adult, a moderate infestation may easily remain unnoticed, especially when affecting varieties of hard cane. The caterpillars are usually seen during stripping or loading operations, being forced to explore the surface of defoliated canes in search of congenial hiding-places. Pupation takes place under a silken covering previously spun by the caterpillar and completely hidden under pellets of excreta. The pupa is usually concealed between the leaf-sheath and cane-stalk and attached near the base of the former. By day, the moth rests in a conspicuous position on leaves of sugar-cane, etc., and probably oviposits on the rind between stem and leaf sheath. Natural control is perhaps exercised by parasitic Hymenoptera, though as yet none have been bred from the scanty material collected. A small earwig and two or more brightly coloured cockroaches of arboreal habits are probably predaceous upon it. This pest does not call for remedial action unless affecting cane-cuttings of soft varieties intended for seed. The introduction of infested cane into districts brought under sugar-cane for the first time should be avoided as far as possible. A simple and inexpensive method of disinfection, which has been found to promote better germination and also increase the final yield, consists in immersing the cuttings in Bordeaux mixture solution for one hour before they are planted. Bananas should not be grown close to sugar-cane, as their succulent leaf-stalks afford nourishment to the larvae.

To get rid of Black Ants.—*Queensland Agric. Jl., Brisbane*, N.S. iii, no. 2, February 1915, p. 81.

Corrosive sublimate is stated to be the best substance for destroying black ants. Carpet-rag strings dipped in it and fastened round the buildings will cause them to leave at once. If a tree or building be smoothed to a width of about 6 or 7 inches, and this space well rubbed with chalk, the ants will be absolutely prevented from climbing. The chalk should be renewed from time to time. Other remedies are: Washing with a solution of ammonia, washing with carbolic soap, and pouring gasoline into the nests. White lime (slaked), 6 quarts; kerosene oil, ½ pint; turpentine, one wine-glass; soft soap, 5 lb.; cowdung, 3 quarts; water, 16 quarts, makes a wash for houses or trees. None of these remedies is however permanent, but all require frequent repetition.

RAINBOW (W. J.). **Two Beetles apparently new to Australia.**—*Australian Zoologist, Sydney*, i, no. 2, 22nd February 1915, p. 46.

A specimen of the Cerambycid, *Eburia quadrimaculata*, new to Australia, has been obtained from an imported oak chair, in which the larval and pupal stages were probably passed. The species has previously been recorded in Porto Rico, Guadeloupe and St. Thomas, West Indian Islands. Another importation of economic interest is the Dermestid, *Attagenus piceus*, Oliv., the carpet beetle, found on woollen materials imported from London.

Froggatt (W. W.). **Insect Pests of the Strawberry.**—*Agric. Gaz. N.S.W., Sydney*, xxvi, no. 2, February 1915, pp. 133–137, 1 pl.

In the coast districts of New South Wales at least four species of Rhynchota are commonly found in the strawberry beds, where they either feed upon the ripe fruit or taint it. The Pyrrhocorid, *Dindymus versicolor* (the harlequin fruit bug), and the Lygaeids, *Nysius vinitor* (the Rutherglen bug) and *Oxycarenus lectularis* (the coon bug) feed on the fruit. *N. vinitor* is one of the worst pests upon all field crops and ripe fruit, and though rarely recorded on the strawberry, it should be looked for on account of the enormous numbers that appear in early summer. *O. lectularis* is a closely allied species with very similar habits. *Dictyotus plebeius* (the brown ground bug) crawls about the strawberry foliage and imparts a very objectionable taint to the fruit. Clean cultivation and the clearing of the ground along the fences, are a great help in keeping these pests away. In large gardens, strawberry beds in the centre of the ground are much less subject to infestation than those on the boundary. In New South Wales there are several Carabids attacking ripe strawberries, and one of the large *Clivina*, which usually frequent damp situations, is very common in the beds. If numerous, these beetles should be trapped by sinking clean milk or jam tins level with the soil. *Anoplognathus analis* (the shining cockchafer) has been found infesting strawberry beds. The adults feed upon the foliage of various species of *Eucalyptus*, and sometimes swarm on the introduced *Schinus molle* (pepper tree), grown largely as a shade tree in all parts of Australia. They lay their eggs in vegetable mould or earth thickly impregnated with humus, upon which the larvae feed. Where the soil is friable, it is possible to dig out a large number of these white grubs with a small fork without seriously disturbing the infested plants. The application of such dressings as kainit or nitrate of soda is recommended, for they not only damage the larvae and pupae, when in contact with them, but promote the growth of the roots. For several years previous to its description by Pascoe in 1873, *Rhinaria perdix* (the strawberry weevil) had been known to strawberry growers in Tasmania and Victoria. It is now said to be almost unknown in the latter State and not a very serious pest in the former. The present is believed by the author to be the first report of its occurrence in New South Wales, where it would seem that the beetles are fully developed and leave their winter quarters, in the crown of the plant, between the end of August and the early part of November, and during that time they deposit their eggs in the crown, the life-cycle being apparently completed in a year. If, in an infested area, all the plants are dug up and burnt, it would mean very slight danger of infestation the next season in freshly planted beds. Clean cultivation is necessary, and trapping with pieces of board laid among the plants will give good results.

The Use of the Hydrometer in connection with Lime-Sulphur Sprays.—*Agric. Gaz. N.S.W., Sydney*, xxvi, no. 2, February 1915, pp. 149-152, 4 figs.

The notes given in this article are largely based on the work carried

out by Mr. A. A. Rumsay, Assistant Chemist, Department of Agriculture, N.S.W. The specific gravity of lime-sulphur solutions as an index of sulphur and lime content, the ascertaining of the specific gravity by means of either the Baumé or Twaddell hydrometer, and the method of diluting stock solutions, are concisely and clearly dealt with. The hydrometer is described, and there is included a table, ranging from 2° to 35° Bé. (2·8° to 64° Twaddell), which shows the number of gallons and pints of water required to each gallon of stock solution of varying density in order to produce sprays of "summer" strength of approximately 1° Bé., "winter" strength of about $3\frac{1}{2}$° Bé. and "Citrus trees" strength of about $1\frac{1}{2}$° Bé. Experience with lime-sulphur at the various departmental orchards has shown that, for winter application, 1 in 7 is the greatest strength that should be applied.

URICH (F. W.). **Entomologist's Report.** *Minutes of Meeting of the Trinidad Bd. Agric.* no. 2. 17th February 1915, p. 8.

During a visit to the Mitan district no cacao beetles (*Steirastoma depressum*) were observed and thrips were only present in numbers too small to cause injury. At Chatham, on the contrary, cacao beetles were very numerous. Parasol ants (*Atta cephalotes*) having been proclaimed a pest under the Plant Protection Ordinance, it should be noted that the best time to destroy their nests is from February to May, or just before the rains commence. It is necessary to destroy the nests before the flying forms appear, or they will scatter and found new colonies.

URICH (F. W.). **Cassava Insects.** *Bull. Dept. Agric., Trinidad and Tobago, Port-of-Spain, Trinidad,* xiv, no. 2, 1915, pp. 38–40.

Lonchaea sp., the bud maggot, is the most important insect pest of cassava. The eggs are laid on the buds, and the larva bores into the soft tissues of the growing point, which it completely destroys. Pupation takes place in the ground. In Cuba, the larval period occupies 23 days, the pupal period, 26 days. The best control measure seems to be to cut and burn infested shoots. A small mite frequently causes the leaves to become dwarfed and spotted; the under surface of the leaves should be sprayed with a weak solution of lime-sulphur. *Erinnyis ello*, the cassava hawk-moth, is kept in check by natural enemies; *Telenomus* sp. destroys the egg, while *Microgaster* sp. is parasitic in the larva. *Lasiopteryx* sp., the gall midge, deposits its eggs in the cassava leaves, but is kept in check by Hymenopterous parasites. *Corynothrips* sp. has been found on the underside of young leaves, but not in sufficient numbers to cause any damage. It is controlled by a parasitic fungus, probably an *Entomophthora*. The cassava lace-wing bug and parasol ants (*Atta cephalotes*) have been recorded on cassava, but only the latter do serious damage. In Cuba, the following pests are important: The Longicorn beetle, *Lagochirus obsoletus*, burrowing into the growing stems, and the larvae of *Lonchaea chalybea* and *Erinnyis ello*. In St. Vincent, *Corythuca* sp., *Frankliniella* sp. and *Corynothrips* have been observed on cassava; in Southern Nigeria, a locust, *Zonocerus variegatus*, has been known to defoliate the plants.

Entomological Notes.—*Bull. Dept. Agric., Trinidad and Tobago, Port-of-Spain, Trinidad,* xiv, no. 2, 1915, pp. 63–64.

Cacao beetles (*Stirastoma depressum*) and thrips have been reported from the districts of Moruga, La Lune and Sangre Grande. In the first two places control work is being undertaken, consisting of spraying and cutting out the larvae. In Sangre Grande, fields which have been drained and to which pen manure has been applied, are free from thrips. Cacao beetles have been troublesome on an estate in the heights of Arima; young trees, which seem to suffer most, should be sprayed or painted twice a year with lead arsenate. The attempt to control thrips by dusting with a mixture of 1 part flowers of sulphur and 10 parts slaked lime, has not had very successful results. Considerable damage has been caused at Chaguanas by *Brassolis sophorae,* the coconut butterfly. The attack was probably due to the absence of natural enemies. The control of the larvae is comparatively easy, since they collect in nests during the day. In January 1915, the cacao beetle was officially declared to be a pest. An invasion of locusts, *Schistocerca* sp., has been reported from Cuidad Bolivar, Venezuela. Black-birds or torditos have materially aided in destroying both this and other insect pests.

Gibson (A.). **The Control of Locusts in Eastern Canada.**—*Dominion of Canada Dept. Agric., Ottawa, Ont.,* Entom. Branch, Circ. no. 5, 1915, 8 pp., 6 figs.

During 1912–14, locusts were extremely numerous and destructive in the provinces of Ontario and Quebec. The crops attacked were oats, barley, rice, wheat, clover, etc. The following species were chiefly responsible for the damage:—*Melanoplus atlantis, M. femur-rubrum, M. bivittatus* and *Camnula pellucida.* A poisoned bran mixture, consisting of bran, 20 lb., Paris green or white arsenic, 1 lb., molasses, 2 qts., water $3\frac{1}{2}$ gals. and 2 or 3 oranges or lemons, has been found most effective. The mixture should be scattered over the field in early morning while the insects are still in the hopping stage, before they begin to migrate. Criddle mixture, consisting of 1 lb. Paris green, 1 lb. salt, 15 gals. horse droppings, and water, has been successfully used in Manitoba. Old pasture land known to be used for egg-laying should be ploughed to a depth of 6 inches after the eggs have been deposited, i.e., in late autumn.

Gibson (A.). **The Army-Worm,** *Cirphis (Leucania) unipuncta,* **Haw.** —*Dominion of Canada Dept. Agric., Ottawa, Ont.,* Bull. no. 9, 1915, pp. 34, 19 figs.

The army-worm assumes the marching habit only when there is a lack of wild, succulent grasses, upon which it normally feeds. Two annual broods occur in Canada, the moths appearing in June and in the autumn. Those emerging late in the year lay eggs which hatch in from 10–12 days. The larvae winter in an immature condition beneath tufts of grass, and in spring, complete their growth. In June, moths from these larvae emerge and deposit eggs for the second brood. In years of abundance, the army-worm is attacked by Dipterous

and Hymenopterous parasites. Of the Tachinids, *Winthemia quadripustulata* deposits its eggs in the larva, and *Phryxe* (*Exorista*) *vulgaris*, *Phorocera claripennis*, and *Wagneria sequax* have been reared from the adult. Among the Braconids, several species of *Apanteles* are useful parasites. The eggs of various Ichneumons, *I. canadensis*, *I. laetus*, *I. leucaniae*, *Paniscus geminatus*, and *Pimplidea pedalis*, are laid in the larva of the host. The most important predaceous enemies are ground beetles of the genus *Calosoma*, various birds, toads and skunks. Bacterial and fungus diseases are known. The most effective artificial method of control is trench digging; the trenches should be 14 inches deep, with post-holes 1–2 feet deep at intervals of 15 feet. The side next the crop should be vertical. Many caterpillars are trapped in the post-holes and can be destroyed in coal-oil. Poisoned bran mixture, scattered thinly over the field, has had very good results in New Brunswick. Spraying with Paris green or lead arsenate should be carried out in front of the line of march of the caterpillars and is only satisfactory where the foliage is dense and an area 4 or 5 rods wide is sprayed. In the autumn following a severe outbreak, old grass and stubble should be burnt over and then deeply ploughed, in order to destroy young hibernating larvae. The adults are readily attracted by the sugar-bait used in the collection of Noctuid moths. The recent outbreaks in Ontario, Quebec, New Brunswick, Nova Scotia and Manitoba, are also described.

Britton (W. E.). & Davis (J. W.). **Gypsy Moth control work in 1914.** —*Rept. Connecticut Agric. Expt. Sta., 1914, New Haven*, 1915. pp. 129–134, 1 fig.

The control work during 1914, consisted of the inspection of various localities, the collection of egg-masses, larvae and cocoons, and the banding of infested trees with tanglefoot or burlap. In some cases trees were sprayed with an insecticide or pruned. Colonies of *Calosoma* beetles were imported into two districts. The present infestation in Connecticut is on the edge of the large gipsy moth area covering Rhode Island, eastern Massachusetts, New Hampshire and Maine; hence the future methods of control will necessarily be somewhat different from those employed in the past.

Britton (W. E.) & Davis (J. W.). **Suppression Work against the Brown-Tail Moth in 1914.** *Rept. Connecticut Agric. Expt. Sta., 1914, New Haven*, 1915, pp. 135–142, 1 fig.

Owing to the spread of *Euproctis chrysorrhoea* during the last two years, it has become impossible to inspect the entire State. The work during 1914 has been limited to the towns just east and west of the government quarantine line.

Lowry (Q. S.). **The Cabbage Root Maggot,** *Phorbia brassicae*, **Bouché.** —*Rept. Connecticut Agric. Expt. Sta., 1914, New Haven*, 1915, pp. 142–152, 3 figs., 4 plates.

The cabbage root maggot, *Chortophila* (*Phorbia*) *brassicae*, was introduced into America from Europe during the last century and at the present time is found in almost every State. It is confined to

cruciferous plants. Among the natural enemies are a Hymenopterous parasite of the genus *Trybliographa*, the Staphylinid beetle, *Aleochara anthomyiae*, a species of *Trombidium*, and an Ichneumon, *Alysia manducator*. In the artificial control of the pest, clean culture, rotation of crops and autumn ploughing are advisable. Tarred paper disks placed round the plant at the soil level will prevent the adult from reaching the ground to deposit eggs. Crude carbolic acid emulsion, consisting of 1 lb. hard soap or 1 qt. soft soap, 1 gal. boiling water and 1 pt. crude carbolic acid, has been found most effective in experimental work. Carbon bisulphide poured into the soil two or thee inches from the plant is also satisfactory ; the liquid must not come into direct contact with the roots. Kerosene emulsion, consisting of 2 gals. kerosene, $\frac{1}{2}$ lb. soap and 1 gal. water is effective, but needs two or three applications. A solution of corrosive sublimate, at the rate of 4 oz. to 55 gals. water, has been successfully used.

BRITTON (W. E,) & LOWRY (Q. S.). **Field Experiments in controlling the Cabbage Root Maggot in 1914.**—*Rept. Connecticut Agric. Expt Sta., 1914, New Haven*, 1915, pp. 152–157.

The following substances were used in the experiments against *Chortophila brassicae*, tarred paper disks, sludge (residue from the manufacture of lime-sulphur mixture), kerosene emulsion, crude carbolic acid emulsion, naphthalene, fish oil, sirenia oil and cresol. In the experiments at New Haven, tarred paper disks and carbolic acid emulsion were most effective, kerosene emulsion least so. Sludge, applied as a paste around the roots of the plant, was very useful against this pest and also against cutworms. The use of sirenia oil mixed with sawdust and scattered at the roots resulted in the death of the plants.

BRITTON (W. E.). **Outbreak of the Army Worm,** *Heliophila unipuncta*, **Haw.**—*Rept. Connecticut Agric. Expt. Sta., 1914, New Haven*, 1915, pp. 157–173.

During July 1914, numerous serious outbreaks of *Cirphis* (*Heliophila*) *unipuncta* occurred in Connecticut, especially in fields of oats. In one of the fields visited by the author the bare stalks only were left. Birds, especially starlings, bar swallows and English sparrows, were abundant and were apparently eating the caterpillars. Of those examined, 40 per cent. had Tachinid eggs attached to them. Clusters of Hymenopterous cocoons were present in abundance and dead and diseased individuals were found, having been attacked by a " wilt " disease. In other localities millet, maize and melons were attacked. The outbreak was not confined to Connecticut, but extended through the North-eastern States as far as the Mississippi, being especially severe in Long Island, Maryland and Michigan. Numerous records of previous outbreaks are given. The chief damage is done to graminaceous crops. Two other kinds of army worms are known, *Meliana* (*Heliophila*) *albilinea*, Hb., which attacks and eats off the heads of grain at the time of ripening, and *Laphygma frugiperda*, the fall army worm, appearing in September and eating grass, millet, maize,

etc. Although a native of America, the army worm is also known in many parts of the world. In North America it occurs usually in the Atlantic States, and though it is seldom injurious in the southern ones, it has been known to cause damage as far west as Kansas and Nebraska. In one locality, *Agrotis unicolor*, Wlk. (*Noctua clandestina*) was found accompanying the army worm, feeding on the same plants and doing the same kind of damage. The natural enemies include domestic fowls, birds, toads and frogs, skunks, certain ground beetles, *Calosoma scrutator*, *C. calidum*, *C. willcoxi*, *C. externum* and *C. frigidum*, probably also the European species *C. sycophanta*, and some PENTATOMIDAE. An important parasite of this pest is *Winthemia quadripustulata*, the red-tailed fly. *Goniomima* (*Belvosia*) *unifasciata*, another Tachinid, has been reared from eggs found on the caterpillars. Hymenopterous parasites include the Ichneumons, *Amblyteles suturalis*, Say, *A. flavizonatus*, Cress., *Ophion purgatus*, Say, *Apanteles militaris*, *A. congregatus*, and the Chalcids, *Haltichella perpulchra*, *Glyphe viridescens* and *Spilochalcis* (*Smicra*) *albifrons*. *A. militaris* is probably the most important of these, at least in Connecticut. The "wilt" disease is apparently caused by bacteria. From a study of former outbreaks, it seems that serious damage seldom occurs for two consecutive seasons in the same locality. In small infestations domestic fowls may be utilised to eat the caterpillars. It is often possible to take advantage of existing walls, roads or ditches, or if these are wanting, to plough deep furrows across the line of march. The furrows should be 6 inches deep, and perpendicular on the side opposite the approach of the larvae. The latter will collect in deep holes in the bottom of the furrow and can be killed with kerosene or by crushing. The caterpillars may be deflected from their course by asphaltum oil, kerosene, or some heavier petroleum oil, sprinkled along the ground. Poisoned bait, made of bran mash, molasses and water, with white arsenic or Paris green, is useful. Grain or grass may be sprayed with Paris green or lead arsenate (6 lb. of paste, or 3 lb. dry, in 50 U.S. gals. of water) to kill the advancing caterpillars. Autumn ploughing is advisable for the control of army worms; thorough harrowing of badly infested fields will destroy many larvae and pupae by crushing and by bringing them to the surface where birds can eat them. Grain, if nearly ready to cut when first attacked, may be saved by prompt harvesting and carting to a field not infested.

WALDEN (B. H.). **Experiments in controlling the White Pine Weevil.** *Rept. Connecticut Agric. Expt. Sta., 1914, New Haven,* 1915, pp. 173–176, 1 plate.

The only remedy at present known for the control of the white pine weevil (*Pissodes strobi*), is to cut off infested leaders in early July, before the adults emerge, and either burn them, or store in such receptacles as will prevent the escape of the adults while allowing that of any parasites. The adults hibernate in winter, appearing on the leaders in spring, where they feed before egg laying. Tests in spraying the leaders at this period with lime-sulphur and lead arsenate have had no definite results. Dr. E. P. Felt recommends the use of a net about 15 inches in diameter for the collection of the weevils. Collection should begin in April and continue for several weeks.

Britton (W. E.), Walden (B. H.) & Lowry (Q. S.). **Experiments in controlling a Mite (*Tarsonemus pallidus*, Banks) injuring Snapdragon Plants in the Greenhouse.** *Rept. Connecticut Agric. Expt. Sta., 1914, New Haven*, 1915, pp. 176–179, 1 plate.

The following experiments were made in attempting to control *Tarsonemus pallidus*, a mite causing the curling up of the leaves of snapdragon plants. Some plants which had been cut back were sprayed with nicotine solution "Black Leaf 40," using 5 cc. to 1 gal. water with naphtha soap added in the proportion of 4 lb. to 100 gals. water, or with "Fir-tree Oil," using 6 fluid oz. in 2 gals. water. Others, which had been less infested, were sprayed with "Black Leaf 40," at the rate of 5 cc. to 1½ gals. water, or with "Fir-tree Oil," using 4 fluid oz. in 2 gals. water. Spraying was repeated three times at intervals of a week. It was found that either of the above insecticides at the greater strength will control the mite if four applications are made at intervals of a week. It is possible that *T. pallidus* attacking *Chrysanthemum* can be controlled in the same way, if it is present on the buds before they open. The same species has also been reported on *Cyclamen*.

Caterpillars feeding on Greenbriar. *Rept. Connecticut Agric. Expt. Sta., 1914, New Haven*, 1915, pp. 183–185.

The larvae of *Trachea* (*Hadena*) *turbulenta* are recorded on *Smilax rotundifolia*. A description of the larva and adult is given. Though the insect cannot be called injurious, in those localities of New Jersey in which the native host plant is cultivated, certain control measures are necessary. Spraying with lead arsenate would prove effective.

Entomological Features of 1914. *Rept. Connecticut Agric. Expt. Sta., 1914, New Haven*, 1915, p. 186.

During the spring of 1914 canker worms (*Palaeacrita vernata*) and tent-caterpillars (*Malacosoma*) were abundant. The Colorado potato beetle (*Leptinotarsa decemlineata*) was scarce, on account of the numbers of its Dipterous parasite, *Doryphorophaga* (*Phorocera*) *doryphorae*. The most important features of the year were the gipsy moth invasion and the army worm outbreak. The elm-leaf beetle, which formerly was confined to sea-level, has become destructive at higher altitudes.

Miscellaneous Insect Notes. *Rept. Connecticut Agric. Expt. Sta., 1914, New Haven*, 1915, pp. 187–198, 5 plates.

The butterfly, *Polygonia interrogationis*, has been abundant on elm in 1914; other food-plants are hop, blackberry and linden. The insect hibernates as an adult. *Eriocampoides* (*Caliroa*) *limacina*, the cherry or pear slug, can be controlled by lead arsenate spray. Several cases of injury to the tulip tree by the Coccid, *Toumeyella liriodendri*, have been reported. Spraying the dormant trees with lime-sulphur is the best control measure. *Asterochiton packardi*, the strawberry whitefly, can be treated in small plantations by spraying the underside of the leaves with "Black Leaf 40"; in large areas,

the only method is to burn over the field in the autumn. Various plants, including currants, gooseberries, etc., are injured by the Capsid, *Poecilocapsus lineatus*, F., the four-lined leaf bug. The eggs are laid in the stems in the autumn, hatching out in May or June. The larvae attack the young terminal leaves, sucking the sap and causing brown spots. Spraying with "Black Leaf 40" is the best remedy. *Oxyptilus periscelidactylus*, the grape plume moth, cannot be regarded as injurious, since growth does not seem to be checked by the larvae. In large vineyards no remedial measures are adopted. The Colorado potato beetle (*Leptinotarsa decemlineata*) has been successfully controlled by the use of either lead arsenate or zinc arsenite, both of which kill the larvae and do not injure the foliage. The Jassid, *Gypona flavilineata*, has been observed on the Japanese barberry; spraying with nicotine solution seemed to have little effect. The green apple aphid, *Aphis pomi*, can be successfully controlled by spraying or dipping into a solution of Black Leaf 40, at the rate of 1 teaspoonful in 1 gal. water. The only record of the harlequin bug, *Murgantia histrionica*, in Connecticut is a specimen found at Meriden in 1910. *Rhyacionia* (*Evetria*) *buoliana*, the European pine shoot moth, has recently been introduced from Europe; the larvae feed on the growing buds. Control measures cannot as yet be recommended. Oak, maple and apple have been attacked by *Elaphidion villosum* (oak twig-pruner). The larva of this species forms tunnels in the wood under the bark towards the base of a branch. The latter breaks off in strong winds and falls to the ground carrying the larva with it. Pupation takes place in the burrow; the adult emerges in the following spring. The only control measure is to burn the fallen twigs. The pear psylla (*Psylla pyri*) is easily killed by the use of "Black Leaf 40," one-half pint in 50 gals. water. The stems of herbaceous plants are often attacked by the larva of *Papaipema nebris* (*nitela*), which tunnels in the pith, finally causing death. *Lygidea mendax*, the false red bug, has caused considerable damage to apple trees by sucking the sap from fruit and foliage. Thorough spraying with nicotine solution in combination with lead arsenate, lime-sulphur or Bordeaux mixture, gives satisfactory results. A similar spray can be used against *Scolytus quadrispinosus*, the hickory bark-borer; the solution should be applied in June.

THOMPSON (J. B.). **Report of the Special Agent in Charge.** *Rept. Guam Agric. Expt. Sta., 1914, Washington, D.C.*, 26th February 1915, pp. 7–18, 2 plates.

An Aphid frequently attacks cucumber leaves in Guam and causes much damage. The simplest control method, where plantings are in close proximity to a line of pipe carrying a sufficient amount of pressure, consists in training a stream of water upon the plants through a garden hose fitted with a nozzle constructed for throwing a solid stream. This may also be applied to Aphids infesting okra plants. Okra also sometimes suffers from a lepidopterous larva, which bores into the young seed pods. Egg-plants are frequently attacked by Aphids, and a mealy-bug also occasionally occurs on them. Lettuces, peppers, or carrots have no serious insect pests in Guam. Radishes are frequently attacked by the larva of *Hellula undalis*, which defoliates them and sometimes enters the root at the crown. This pest does not seem to

appear at regular intervals, or at definite seasons. Usually a crop planted at any time from November to February, the season during which the radish succeeds best, will escape the ravages of this pest, though this is not certain. Spraying with lead arsenate has been attended with fair results. The larva of a small moth sometimes destroys the crop of Lima beans by feeding within the pod, when nearly mature. A small leaf-miner attacks the leaves of both Lima and string beans, but apparently has little influence on production.

Back (E. A.) & Pemberton (C. E.) **Life-History of the Mediterranean Fruit-Fly from the Standpoint of Parasite Introduction.** —*Jl. Agric. Research, Washington, D.C.*, iii, no. 5, 15th February 1915, pp. 363–374, 2 plates, 6 tables.

The failure of Silvestri to introduce *Tetrastichus giffardii* into Hawaii is ascribed to the short life of the parasite and its habit of ovipositing in either the egg or young larva of *Ceratitis capitata.* The writers have developed simple methods of rearing *Ceratitis capitata*, which have resulted in the prevention of many failures in connection with the introduction of parasites, since they provide a means of making available the various stages of the fruit-fly for the rearing of new generations of parasites. The usual method of obtaining a colony of fruit-flies consists of placing infested fruit over sand in some securely screened container. The simplest way is to use a contrivance which will keep the fruit free from the sand and at the same time bring the emerging larvae to a central point. This is a funnel of galvanised iron, held in a suitable support, with a half-inch mesh screen at the bottom. Larvae, as they emerge, work their way downwards into the container below. This arrangement works well with various fruits. The old method of using a shallow box, covered with a varying depth of sifted sand, required a great deal of time; the writers now use a frame 6 by 3 by 3 feet, a figure of which is given. The old box system is useful when it is desirable to keep separate pupae from small lots of fruit from different localities. The sand below is kept dry and can be easily sifted to obtain the pupae. The adults generally emerge early in the morning during warm weather; for food, fruit juices of any kind may be given, or water sweetened with pine-apple juice or a mixture of water and finely divided papaya. When not required for oviposition, the flies can be kept alive by suspending a juicy fruit within the jar. Fed in this way and kept at a temperature of 58°–63° F., adults have been kept alive for six months; when the average temperature is 76°–79°, the longevity is only about three months. Males attain sexual maturity in about four days after emergence, females in about 6–8 days. The time of oviposition after emergence varies with the temperature; at a mean temperature of 74°, eggs are laid in 7–8 days. The females lay small batches of eggs quite regularly throughout life.

Differences exist between the habits of the adults of *Bactrocera cucurbitae*, Coq. (the melon fly), and those of *Ceratitis capitata.* The melon fly adult lives more than six months, exhibits no sexual activity for 20–25 days after emergence, and flies only at sunset. The female is more irregular in her habits of oviposition, but a larger number of eggs are laid at one time. Eggs of *C. capitata* can be obtained by

suspending fruit in a jar containing adults, after the latter have begun to mate. If the eggs are to be closely observed, they should be removed from the fruit and spread upon a firm leaf. The leaf is inserted in a small tube, a cotton plug added to force the leaf to the bottom, and the whole inverted and partially submerged in water. An ordinary moist chamber is not so successful. The length of the egg stage varies from 2–7 days at temperatures ranging from 78·9°–62° F. The larvae pass through three instars. The length of larval life varies from 6–14 days and seems to be influenced by the food. Citrus fruits are not suitable for rearing work with either flies or the egg-parasites. Adults should not be permitted to lay more than 150 eggs in such fruits as the apple, as overinfested fruits decay too rapidly.

PATCH (E. M.). **Two Clover Aphids.** *Jl. Agric. Research, Washington, D.C.*, iii, no. 5, 15th February 1915, pp. 431–433, 3 figs.

Aphis brevis, Sanderson, the long-beaked clover aphid, has been found attacking leaves of *Crataegus* sp., and *Cydonia japonica*, the Japanese quince. During the month of June the leaves are swollen and curled and have a dark purple colour; in late June and July, the Aphid leaves the hawthorn, returning late in the season for the sexual generation. Autumn migrants have been obtained from *Prunus* sp., but no spring collections have been made from that host. In the transfer tests carried out in 1912 migrants placed on alsike and white clover fed satisfactorily and produced nymphs. Somewhat later, colonies of the Aphid were found to have infested the bases of *Lathyrus odoratus* growing near a hawthorn. *Aphis bakeri*, Cowen, the short-beaked clover aphid, reported on *Trifolium pratense* at Orono, Maine, is distinguished from the above species by the character of the antennae. It generally occurs on the ventral side of the leaf and the stem near the ground. Specimens have also been taken from hawthorn, apple and shepherd's purse.

DUCKETT (A. B.). **Para-dichlorobenzene as an Insect Fumigant.** *U.S. Dept. Agric., Washington, D.C.*, Bull. no. 167, 10th February 1915, 7 pp., 2 figs. 1 table.

The insecticidal value of para-dichlorobenzene as a fumigant, its effect, if any, on cloth fabrics and the action of the vapour on plant life, are discussed. This compound has only recently been used as an insecticide; it is a colourless, crystalline substance, volatilising very readily as a colourless vapour with a peculiar ether-like odour. The vapour is harmless to human beings and domestic animals under ordinary conditions, but in many instances it is poisonous to insects. The greatest advantages which it possesses over other fumigants, are its absolute non-inflammability and its comparatively low cost to purchase or apply, in proportion to the result obtained. Dr. Curschmann has concluded that para-dichlorobenzene is harmful to human beings only in cases of internal application of large quantities, from 30–40 grains. As an insecticide, it is effective only where its vapour can be confined, and at a temperature greater than 74° F.; it is recommended only where poison bait and contact sprays are undesirable. The

amount required is from 12 oz. to 1 lb. to 100 cub. feet of space; between 75° and 85° F. an exposure of 36 hours is necessary, while above 85°, owing to the rapid diffusion of the vapour, 24 hours is sufficient. Since the substance is comparatively cheap and all unvolatilised material can be kept indefinitely, the additional amount required for a larger dose would be an insignificant item. Para-dichlorobenzene is insoluble in water and does not deliquesce when exposed to air, but completely volatilises; it should therefore be kept in an air-tight jar. The vapour is more than five times as heavy as air; a sufficient quantity should be exposed in open receptacles placed higher than the infested goods, e.g. bags of grain or stored products, which require fumigation. As certain insects, e.g. *Calandra oryzae*, the rice weevil, *C. granaria*, the granary weevil, *Tribolium confusum*, the flour beetle, and mealworm larvae possess great tenacity of life, proportionally larger doses should be used for them. Moths, flies, ants, etc., are readily killed by using the strength given above. The action of para-dichlorobenzene is primarily on the nervous system. After exposure to the vapour for a few seconds, the insect displays uneasiness, followed by spasmodic convulsions, and finally turns over on its back. While in this position nervous and muscular reflex action is noticed. In testing the action of the compound as a fumigant, the writer concludes that it works excellently against pests of stored products, case-bearing clothes moths, cockroaches, ants, museum pests, etc., and is also an effective substitute for potassium cyanide in collecting beetles. The chemical and physical properties and composition of the compound are given.

Busck (A.). **The European Pine-Shoot Moth; a serious menace to Pine Timber in America.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 170, 9th February 1915, 11 pp., 6 plates.

The European pine-shoot moth, *Rhyacionia* (*Evetria*) *buoliana*, has been introduced into America on imported European pine seedlings and has become established in several localities in the eastern and middle western states. [See this *Review*, Ser. A, ii, p. 701.] Some idea of the extent and permanent character of the injury which this insect can inflict may be gained from the illustration of a European pine forest which has been infested for several years in succession, with the result that the majority of the trunks are so twisted that their value as timber is materially lessened. *R. buoliana* is confined to pines, attacking all species, especially trees between 6 and 15 years of age, but is often excessively destructive to younger and older trees, though those over 30 years old are rarely affected seriously. Importations of pine from Europe into America take place in autumn, winter and early spring. The young larvae lie dormant in the buds and are easily overlooked. Many larvae die from overheating *en route* or from unfavourable circumstances in handling or transplanting. This is probably the reason why the species is as yet confined to few localities and has only been found in nurseries and private parks supplied by these infested nurseries. Infested twigs are noticeable in spring, but the extent of the injury is realised later in the season, when new growth is found to be destroyed or injured. The injured shoots become deformed and though the injury straightens somewhat during successive years growth, it is always seriously detrimental to the timber.

If the pest is abundant, the trees have no commercial value whatever. Several allied American species are known and like *R. buoliana* are confined to the pine. They often do serious damage to pine forests owing to the fact that there are two generations annually, but their destructiveness cannot be compared with that of the European species. The larva of the native species confines itself to a single bud or twig, and the tree often recovers from the injury without permanent disfigurement. Injury is only serious when the native species are very abundant. Moreover, each is confined to one or a few species of *Pinus*, while the European form thrives on all species, and so has a greater chance of spreading. *R. buoliana* in Europe is kept in check to some extent by parasitic enemies, chiefly ICHNEUMONIDAE. Parasitised larvae of native species have been observed in America, and these parasites in time may attack *R. buoliana*, but will probably not be very effective in controlling it. As the larvae are protected within the buds from any insecticide, the only method of control is pruning and destruction of infested buds. This is best done during autumn and winter, the infested buds being easily recognisable by the exudation of pitch at the base of the bud covering the entrance hole of the larva. It is advisable to examine the trees again in spring, since the injury is then much more apparent. In America, the work of the larva in the autumn is more easily discovered than in Europe. The fact that the species is stationary and only found within definite parts of certain trees, renders control work comparatively easy.

BEAL (F. E. L.). **Food of the Robins and Bluebirds of the United States.** *U.S. Dept. Agric., Washington, D.C.*, Bull. no. 171, 5th February 1915, 31 pp., 2 figs.

Investigations have shown that the food of robins and bluebirds consists largely of insects and that the young feed upon them exclusively. The following orders were found in the food of *Planesticus migratorius* :—Hymenoptera, 3 ; Coleoptera, 196 ; Diptera, 1 ; Lepidoptera, 9 ; Neuroptera, 1 ; Hemiptera, 12 ; Orthoptera, 3. *Sialia sialis*, the eastern bluebird, was found to subsist upon insects to the extent of five-sixths of its food, including Hymenoptera, 5 ; Coleoptera, 127 ; Diptera, 2 ; Lepidoptera, 6 ; Hemiptera, 13 ; Orthoptera, 8 ; Plecoptera, 2. In the food of *S. mexicana*, the following have been found :—Hymenoptera, 1 ; Coleoptera, 21 ; Hemiptera, 2 ; in *S. currucoides*, Coleoptera, 17 ; Hemiptera, 2.

SASSCER (E. R.) & HAWKINS (L. A.). **A Method of fumigating Seed.** —*U.S. Dept. Agric., Bur. Entom., Washington*, Bull. 186, 27th February 1915, 6 pp., 2 figs., 1 table.

A reliable method of destroying insects present in imported seeds, without injury to the seed, is much needed. The ordinary methods, such as exposure to heat, with or without moisture, carbon bisulphide, and hydrocyanic acid in the presence of air, have been found unsatisfactory. Experiments were conducted to determine whether more gas could be forced into the crevices of the seeds if a partial vacuum were first created than would be possible if the entrance of the gas were dependent upon diffusion under normal atmospheric pressure.

A chamber was devised for fumigation under reduced pressure; a detailed description and figures of which are given. Seeds under a pressure equivalent to some fraction of an inch of mercury, were exposed to hydrocyanic acid generated within the chamber. The duration of the exposure and the concentration of the acid were varied in order to determine the minimum exposure and concentration which would prove effective. It was also determined whether the seeds would be injured if exposed longer and with a higher concentration than that necessary to kill the insects. The results in the table indicate that an exposure of a quarter of an hour was effective if 4 grams of sodium cyanide were used; with a less quantity, the exposure should not be less than half an hour. Fumigation by this method was found to kill insects without injury to the seeds and with a considerably shorter exposure than is necessary in the usual method of seed-fumigation. Further experiments are being conducted with special reference to the use of carbon bisulphide.

Snyder (T. E.). **Biology of the Termites of the Eastern United States, with Preventive and Remedial Measures.**—*U.S. Dept. Agric., Bur. Entom., Washington*, Bull. no. 94, part ii, 17th February 1915, 85 pp., 17 plates, 14 figs.

This is a detailed and elaborate account of North American termites, which are among the most destructive insects to the timber industry in that country. *Leucotermes flavipes*, Kollar, and *L. virginicus*, Banks, are especially dealt with. The observations are mainly the result of an investigation conducted in 1910 and 1911 as to the character and extent of damage to telegraph poles and mine props by wood-boring insects. Termites of the genus *Leucotermes* are essentially wood destroyers; excavations usually follow the grain of the wood, a protective outer layer always being left intact. The burrows of other boring insects are often used as a means of penetrating more rapidly to the heartwood. Although usually confined to moist or decaying timber, dry wood is sometimes attacked. Subterranean passages are also inhabited. After swarming, many sexual adults excavate shallow cells in the earth under decaying wood, and later enter the wood. Infestation usually occurs in this way, rather than by an entrance on an exposed surface. The increase in numbers of a colony is slow, corresponding with the slow rate of egg-laying. The period of maximum egg production is during the warm months—from May to early September in Virginia. In winter, termites retreat to the subterranean passages of the colony; in spring, when moisture is abundant, nymphs are to be found in the outer galleries, while in summer, there is a migration inwards to escape the dry and hot conditions. The site of the colony is liable to abandonment if conditions become unfavourable. Data on the duration of life are lacking; workers and soldiers complete their development in one year, while royal individuals probably live at least five years. Swarming occurs 7–10 days after the last sexual adults have acquired wings. The eggs hatch in about 10 days; most of the first brood develop into workers. Young larvae are fed on prepared food and do not eat wood until later in their development. Termites and ants are commonly found inhabiting the same log; ordinarily the relations between

them are peaceful, but if the termite colony be disorganised, the ants at once attack them. Ants greatly diminish the number of colonising individuals at the time of swarming. Three Staphylinid beetles have been recorded as living in colonies of *Leucotermes flavipes*, viz.:—*Philotermes pilosus*, *Homalota* sp., and *Tachyporus jocosus*. All stages of the Scarabaeids, *Homoralgus squamiger* and *Valgus canaliculatus*, are commonly associated with termites in decaying wood. Termites are infested externally with mites and internally with protozoan parasites. The presence of the latter is stated to retard sexual development. New colonies are formed (1) by sexed colonising adults; (2) by neoteinic royal individuals, produced from nymphs of the second form; (3) by neoteinic reproductive forms supplied to orphaned colonies. Colonies formed in the last two ways, increase in size very rapidly owing to numerous egg-laying queens. The damage done is such that numerous methods have been tried to combat them. Timber in contact with the ground should be impregnated with coal-tar creosote. Various methods of superficially treating timber with creosotes, carbolineums, etc., are temporarily effective, if the work is thoroughly done, especially at the base. Before treating with chemical preservatives, especially where the brush method is employed, it is essential that the timber be thoroughly seasoned, otherwise penetration by the preservative will be retarded. "Blue oil," the residue left in the distillation of mineral oils after the isolation of kerosene and paraffin, has been found effective. A saccharine solution containing a salt of arsenic is being tested. Bichloride of mercury and zinc chloride have been found useful if the wood is not in contact with the ground. In general, serious damage to standing timber can be prevented if the timber is utilised within from one to two years from the time it was cut. Where the injury is confined to buildings, fumigation with hydrocyanic acid gas is recommended. Certain species of wood, e.g. *Tectona grandis* [teak], *Nectandra rodiaei* [greenheart] and mahogany, are immune to attack. This immunity is not due to hardness, but to the presence of certain distasteful oils or alkaloids. In certain species of pines, e.g. *Pinus palustris*, the heartwood apparently is resistent. In Southern Rhodesia, the wood of *Copaifera mopani* withstands termite attacks for years and is therefore very suitable for fences. Tests of the relative resistance of various native and exotic woods have been begun, but no definite conclusions have yet been reached.

A bibliography of 59 works is added to this paper.

BEAL (F. E. L.). **Some Common Birds useful to the Farmer.** *U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. 630, 13th February 1915, 27 pp., 23 figs.

An account of the habits and food of 23 species of birds common in the United States is given, based on the results of several years' investigation. In the majority of cases the food consists largely of injurious insects. For example, the eastern meadowlark, occurring from the Atlantic Coast to the Great Plains, feeds on grasshoppers and crickets, various species of May beetles, the larvae of which attack the roots of cereals, the cotton boll weevil and the recently introduced alfafa weevil of Utah. In the case of the phoebe, the food is almost

exclusively made up of insects, mostly those injurious to agriculture, such as click beetles, May beetles, weevils; of the various Hymenoptera eaten, a few are useful parasites. From these and numerous other examples it is obvious that the question of the average diet of birds is one of supreme importance.

WEBSTER (F. M.). **Alfalfa attacked by the Clover-root Curculio.** *U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 649, 27th February 1915, 8 pp., 6 figs.

Sitones hispidulus, F. (the clover-root curculio), though common in Europe, where it is destructive to clover, was not known in the United States prior to 1876. It has become widely diffused there, and did considerable injury to lucerne in 1914. In the latitude of Washington, the adults hibernate from November until the first warm days of spring; the females then begin to oviposit on the plants on the roots of which the young larvae are to feed. On hatching, the larvae immediately go down into the soil. They feed on the roots of all the clovers, but prefer red clover. Lucerne seems to be also a common food-plant and large cavities are eaten in the main roots. The adults eat out irregular patches from the margin of the leaf, but the damage they do is only noticeable when they occur in considerable numbers. The first absolute proof of serious injury to lucerne was secured in May 1914 in Maryland. Early in July, complaints were also received from Pennsylvania. According to Wildermuth, no Hymenopterous or Dipterous parasites have been observed, but the larvae are attacked by a fungus, one of the Entomophthorae, and the following birds feed upon the adults: Upland plover, killdeer or killdee, ruffed grouse, broad-winged hawk, flicker, night-hawk, wood pewee, crow blackbird, meadowlark, Lincoln finch, chipping sparrow, white-throated sparrow, song sparrow and chimney swift, especially the two last-named. A short rotation of the lucerne crop will tend to limit the abundance of the pest in the fields. Disking or harrowing as soon as the first hay crop is removed, are the only measures at present suggested; they will in all probability largely reduce the pest in the following season.

DEAN (G. A). **The Spring Canker-worm Situation in Kansas.**—*Kansas Agric. Expt. Sta., Manhattan*, Circular no. 46, 1st February 1915, 7 pp., 7 figs.

The injury wrought by the spring canker-worm (*Palaeacrita vernata*) to fruit and forest trees in Kansas, was more serious in 1914 than in former years. More apple trees were killed in a single season than by the San José scale during its entire history as a pest in the State.

The pupae pass the winter from two to five inches beneath the surface of the ground; the moths usually emerging in March. The oval, yellowish eggs are deposited by the females in masses on the branches of the trees, and are usually sheltered beneath loose bark, fruit spurs or leaf scars. The larvae hatch either at the time of the unfolding of the leaves or at the time of full bloom. They feed on the leaves, flowers and setting fruit, reaching their full size three or four weeks after hatching. They then enter the ground, pupate, and remain until

next spring. Three methods of control are in use: First, a thorough cultivation of the orchard after the caterpillars have entered the ground to pupate; secondly, by the spraying method; thirdly, by banding. In the second method, the trees are sprayed, as soon as the leaves are partly expanded, with lead arsenate, using two to three pounds in fifty (U.S.) gallons of water. In the third case, bands of paper smeared with pine tar, coal tar, printers' ink, dendroline or "tree tanglefoot" are fastened round the tree. Cotton or cotton batting about two inches wide is first placed round the tree, and over this the tarred paper. On badly infested trees, the adhesive substance should be frequently renewed.

DEAN (G. A.). **Insects destructive to Grain and Grain Products stored in Bins and Granaries.** *Kansas Agric. Expt. Sta., Manhattan.* **Circular no. 47, 15th February 1915, 4 pp.**

With the exception of the Angoumois grain moth (*Sitotroga cerealella*), the attacks of moth larvae in grain or meal can be distinguished from those of beetles by the presence of web or silk. The simplest and most effective remedy is fumigation with carbon bisulphide, the amount used being dependant on the temperature, size of the building and the nature of the attack. Experiments with *Tribolium confusum* and *Calandra oryzae* have shown that if the building be reasonably air tight and the temperature above 70° F., 5 pounds of carbon bisulphide is sufficient for every 1,000 cub. ft. of space, or one pound to every 25 bushels of grain. If the building be not air-tight, the amount should be doubled or trebled. Care should be taken to avoid delays and to facilitate the rapid evaporation of the liquid. The latter should be placed in shallow pans at the top of the building, not more than a pound in one place. In large bins, a small quantity of the liquid poured into the middle of the grain through a tube is not injurious either to the edible or germinating qualities of the seed. Exposure of 36 hours for germination purposes, or 48 for eating, is sufficient. The building should be thoroughly ventilated after fumigation. Owing to the inflammable nature of the liquid, no light of any kind should be allowed near during the process. To avoid infestation of stacks, grain should be threshed as soon as possible after harvesting.

SANFORD (F.). **In regard to the Poisoning of Trees by Potassium Cyanide.** [Correspondence.] *Science, Philadelphia*, xli, no. 1049, **5th February 1915, pp. 213–214.**

The success of the author's experiment with potassium cyanide [see this *Review*, Ser. A, iii, p. 73] is confirmed by the fact that 10 months later, the wood and bark around the hole in which the cyanide was inserted, was only discoloured for less than ¼ inch, the bark having begun to grow over the opening.

SHATTUCK (C. H.). **Effect of Cyanide of Potassium on Trees.**—*Science, Philadelphia*, **xli, no. 1052, 26th February 1915, p. 324.**

The author states that his own results with potassium cyanide, especially on elms and black locust trees, convince him that potassium

cyanide is a valuable remedy. Large groves of these trees in Kansas and other places, have been completely rescued from the attacks of boring and girdling insects, by means of this poison. It is suggested that where discolouration has been observed [see this *Review*, Ser. A, iii, p. 73], it is due to a reaction between the tannic acid in the bark and iron in the form of iron sulphate, contained as an impurity in the potassium cyanide.

DODSON (W. R.). *27th Ann. Rept. Agric. Expt. Sta., Louisiana State Univ. for 1914; Baton Rouge*, 1915, 32 pp.

In the department of entomology, several crop pests have been recorded, including the cottony cushion scale (*Icerya purchasi*), *Phylloxera* galls on pecan trees, and citrus canker. The control of the sugar-cane borer by means of parasites has had successful results. The study of the mealy-bug (*Pseudococcus*) and its relation to the Argentine ant (*Iridomyrmex humilis*) has been continued.

KEHRING (H.). *Ephestia elutella* (?) **injuring Earthnut Cake in France.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, vi, no. 2, February 1915, pp. 319–320. [Abstract from *Bulletin des Séances de la Société nationale d'Agriculture de France, Paris*, lxxiv (1914), pp. 864–866.]

The larvae of Microlepidoptera cause damage to stored ground-nut cakes by drilling galleries in them. The commonest species seems to be *Ephestia elutella*. The female moth oviposits on the surface of the cakes and the larvae penetrate into the interior on hatching. Infestation increases with time and cakes which had been stored for 10 or 12 months became hollow and crumbled to pieces when handled. The author believes that infestation may be checked by trapping most of the moths of the first brood in spring before the successive annual generations occur. Ordinary earthen pots containing a 10 per cent. solution of molasses, should be satisfactory.

SAVELLI (M.). *Steganoptycha pinicolana* **on Larches in the Valley of Aosta.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, vi, no. 2, February 1915, p. 319. [Abstract from *Cronaca Agricola, Turin*, xx (1914), p. 177.]

In July 1914, the larvae of the Tortricid, *Enarmonia diniana*, Gn., (*Steganoptycha pinicolana*, Zell.) occurred in large numbers on the larches in the upper part of the valley of Aosta. This pest was first recorded in Italy as causing severe damage to larch woods at Argentera and Bersezio (prov. of Cuneo) in 1901. A detailed description of the various stages of this moth is given.

GOOT (P. van der). **Over Boorderparasieten en Boorderbestrijding.** [On (sugar-cane) borer parasites and control of borers.]—*Meded. v.h. Proefst. voor de Java-Suikerindustrie, Soerabaia*, v, no. 4, 1915, pp. 125–176, 3 plates. [Received 13th May 1915.]

Borers are still the most important pests of sugar-cane in Java, and since Zehntner studied them in 1895–1900, there has been no diminution

in their activity, especially in East Java. Four species and their parasites are dealt with in this report :—*Diatraea striatalis*, Sn. (the striped stalk borer), *Chilo infuscatellus*, Sn., (the yellow tip borer), *Scirpophaga intacta*, Sn. (the white tip borer), and *Olethreutes* (*Grapholitha*) *schistaceana* Sn., (the gray borer). The most important egg parasite of *D. striatalis* is *Phanurus beneficiens*, Zehnt. Eggs infected by *Phanurus*, are easily recognisable in the cane-fields by their brown colour, and if these are collected in glass tubes or glass-topped boxes, there is no difficulty in breeding them out. The adults are attracted by light, the females much more so than the males, so that by the simple process of placing the infected eggs in a test-tube closed at one end with a plug of cotton wool, and exposing the other end to the light, the sexes can be very readily separated on emergence. If the females be provided with eggs of *Diatraea* on a leaf in a glass tube, these are at once attacked, but it was observed that only those were parasitised which were not more than 3–4 days old. It is not necessary that the females should be fertilised for oviposition to take place ; the operation lasts about one minute for each egg attacked, and the parasite apparently confines its attack to one egg-cluster. The life of the adult parasite is very short ; in a dry atmosphere, when denied all access to liquid, barely one or two days. If Muir's method be used, in which a fresh moist leaf is introduced daily (the author used the leaves of *Portulaca oleracea* [purslane] with success) so as to obtain a really moist atmosphere, the life is greatly prolonged. The proportion of the sexes is about equal. When a pair had been left together with a supply of *Diatraea* eggs, the emerging brood of parasites consisted almost entirely of females. Even unfertilised females generally give rise to a majority of females, though occasionally males only were produced. Parasitised eggs, 14 lots, collected in the open yielded 750 females and 70 males ; in four cases, no males ; and it is argued from these figures, that parthenogensis is common in nature. Other egg-parasites of *D. striatalis* are, the Chalcids, *Trichogramma* (*Chaetosticha*) *nanum*, Zehnt., *T. australicum*, Gir., and *T. minutum*, Riley (= *T. pretiosa*, Riley). *T. australicum* was easily bred in the same way as *Phanurus* ; emergence invariably took place by day, but instead of only one parasite per egg infected, as in the case of *Phanurus*, usually two or three and, in a few cases, as many as six were obtained. The adults seek the light, but not so markedly as *Phanurus* ; the parasites emerge in 9–10 days. Parthenogenetic reproduction in the case of *T. australicum*, in seven separate observations, yielded exclusively males, and there is some reason for supposing that this occurs in nature. The life-history of *T. minutum* and *T. nanum* is apparently very similar to that of *T. australicum*, but it was not possible to obtain them in sufficient numbers for study. Bodkin's account for British Guiana is considered to represent fairly conditions in Java [see this *Review*, Ser. A, i, p. 319.] A Braconid and a Tachinid, both undescribed, parasitise the larvae of *Diatraea* ; they are rarely, if ever, found in the burrows and it seems probable that they only attack the larvae when outside. Two species of ant, a large red, and a small black one, attack the pupae and the latter carries off the eggs to their nests ; a small Carabid also eats the larvae. The following list of known parasites of *Diatraea* is given :—Egg parasites : *Trichogramma minutum*, Riley (Br. Guiana, Porto Rico, Louisiana), *Telenomus* sp. (Br.

Guiana); parasites of the larva: *Iphiaulax medianus*, Cam., *Cremnops parvifasciatus*, Cam., *Mesostenoideus* sp., (all from Br. Guiana), *Ophion mauritii* (Mauritius)*, *Lioderma 4-dentatum* (Br. Guiana), *Chauliognathus marginatus* and *Drasterius elegans* (Louisiana). It is suggested that a large importation of larval parasites from British Guiana would be very useful, if combined with a serious attempt to propagate the native parasite on a large scale.

The parasites of *Chilo infuscatellus*, Sn. (the yellow tip borer) are for the most part the same as those of *Diatraea*. According to Zehntner and van Deventer, *P. beneficiens*, Zehnt., attacks the eggs and the author's own observations prove that *T. australicum* is also an important egg-parasite. Neither *T. minutum* nor *T. nanum* have as yet been bred from eggs of *C. infuscatellus* in Java, but it is probable that they are also egg-parasites. The larvae are parasitised to a small extent by an undescribed Braconid and a Tachinid.

No important parasites of *Scirpophaga intacta*, Sn. (the white tip borer) have been found, except *P. beneficiens*, which is said to infect as much as 50 per cent. Zehntner described an *Elasmus* and a *Macrocentrus* as occasionally parasitising the larvae, and early in 1914 an Ichneumonid parasite of the pupa was discovered, which is still under investigation.

Until recently, no parasites of *Olethreutes schistaceana* were known, but in 1913 it was discovered that *T. australicum* and *T. nanum* were to be regarded to a limited extent as egg-parasites. *T. minutum* has not yet been obtained from the eggs and no parasite of the larvae is as yet known in Java.

Diatraea has three maxima of appearance in the year, viz. the end of January, the beginning of April and the middle of June, the largest outbreaks occurring from May to July, and considering the short life of the pest, and the favourable conditions which the climate of Java affords for its development, it is at least probable that the fluctuations in its numbers are directly due to the parasites. When the number of eggs is small, the proportion parasitised is also small, and it is only when the eggs become very numerous that 60 or 80 per cent. are attacked, and the short life of the parasite enables the pest to recover itself and again become numerous. It is probable that enormous numbers of parasites die in these intervals, and it is therefore highly desirable to maintain large supplies of *Phanurus* to act as reserves at the critical periods. The author is of opinion that the percentage of lost and destroyed parasites, after they are set free, may be very high, and the results of eight experiments do not show any very clear or constant relation between the release of parasites and the percentage of attacked eggs. The best possible use to make of the parasites is to release them on quite young plantations, so that they may keep down the pests from the start; the necessary material can always be obtained from the older cane-fields.

The source of infection of new plantations is undoubtedly the older cane-fields. The terms of lease of cane-land in Java require that one-third of the area shall be planted with sugar-cane every year, and thus young cane is often growing alongside cane waiting to be cut,

[*The inclusion of this species is probably due to a record published by M. de Charmoy, but specimens received from him under this name proved to be *Henicospilus antancarus*, Morl.—Ed.]

and it is more than possible that the borer caterpillars are carried on to the young cane by wind. The experimental plots at the station showed that the infection in adjacent cane-fields extended from 75 to 100 yards from the old cane, occasionally much more. The *Diatraea* adult does not appear to fly more than about 200 yards. No data are forthcoming as to the other species but their length of flight is believed to be much greater. The position of the cane-fields with regard to prevailing winds may be important, but the evening wind often blows in exactly the reverse direction to that of the morning, so that some modification of the system of planting would probably do away with this altogether. The life of the cane itself is also important. The variety of sugar-cane commonly grown in Java, stands at least 13 months on the ground, so that it is a common practice to plant at intervals of three months; this plan, for the reasons above stated, favours continuous infection and the practice of not thoroughly clearing the ground when the cane is cut, assists materially in maintaining it. The use of the tops of the canes as sets is strongly condemned, as these are often full of borer eggs, and the sprouting of the sets only provides fresh food for the caterpillars. Another common source of infection is the distribution of egg-masses, which are knocked off the old canes and distributed over the borders of a young plantation close by in the process of handling, and also on the trimmings of the cane sets which are left lying about; every care should be taken in cutting cane to destroy all egg-masses, and to burn all fragments of cane bearing them. Yet another source of infection is found in other food-plants of the borers and especially "glagah" (*Saccharum spontaneum*). *Diatraea* and *Chilo* will also attack maize; no proof has yet been obtained that any of the species attack bamboo. Collection of the eggs is very useful but the scattered eggs of *Olethreutes* escape this process. Rewards for eggs collected have been tried, but it was found that two-thirds of those brought in were not the eggs of borers, but consisted largely of those of *Aleurodes longicornis* and *A. bergi*, as well as eggs of spiders and *Spodoptera* sp.; the natives even manufactured egg-masses which were stuck on to pieces of leaf with gum and required more or less careful examination before the fraud could be detected. Carefully organised and systematic search of young plantations for eggs, by men who can be trusted, and who have been trained to the work, appears to be the really practical method, but it is costly and must be pursued incessantly, as the life of the borers is short, and a whole plantation must be examined at least every four days, especially those parts which are immediately adjacent to old canes. This method has proved successful in the experimental cane fields of the station, but, even there, it was difficult to effect a thorough examination. Usually the first caterpillars are found one month after planting, and the search for eggs should be begun a little before this. Cutting out the attacked shoots to kill the caterpillars is another method of control, but as this may mean removing 40 per cent. of them, the direct loss is very serious. Spraying is not recommended, in as much as the cane grows very quickly and the form of the plant makes effective wetting almost impossible, especially near the top. The operation would also require repetition every three or four days, so that it would be very costly both in labour and material. Trials of Paris green and lead arsenate proved them to be quite useless, as

the borers were much too well protected behind the leaves. The following figures are given for a station cane-field of $29\frac{1}{2}$ acres, which was regularly searched by 11 labourers. It was planted during July and the search for eggs began in the middle of August and lasted four months. In this period 45,098 infested shoots were cut and found to contain 32,605 caterpillars, *Scirpophaga*, 9,889; *Diatraea*, 7,740; *Chilo*, 4,687; *Olethreutes*, 10,289. The total number of egg-masses was 4,815. of which 4,040 were *Diatraea* and the remainder *Scirpophaga*. At the end of the operations, the cane-field was practically free from borers. The opinion has been expressed that, despite such work, pests enough remain to cause such damage that the result is much the same as if no attempt at control had been made and that the cost of control is money thrown away. This very important question does not appear to have been settled one way or the other and the author suggests that it should be thoroughly worked out on two separate cane-fields, one of them to be handled in the ordinary way and the other treated carefully against the borer pests; the result, financially, does not appear by any means to be a foregone conclusion. This lengthy and interesting paper concludes with a brief description of each of the pests dealt with.

TOMEI (B.). **Norme di Viticoltura con riguardo alle Viti Americane ed all'innesto.** [Rules of Viticulture with regard to American Vines and grafting.]—*Urbino*, 1915, 120 pp.

Thirty pages of this book are devoted to fungus and other diseases of the vine. The life-cycle of *Phylloxera* on American vines is stated in the form of a genealogical tree, R. indicating the root-inhabiting and G. the leaf-inhabiting or gall-producing stages. A wintering egg laid by a fecundated female at the end of summer or beginning of autumn, produces, in the following spring, a larva which attaches itself to the upper surface of the leaf, there producing a gall, in which, after four moults, it lays 600 eggs from which result three generations of insects. The third of these consists chiefly of the G. variety and their progeny, the fourth, are almost all of the R. variety, giving rise to the fifth and sixth generations of purely R. *Phylloxera*. From a part of the sixth, the hibernating individuals are derived, the remainder consisting of nymphs and pronymphs. The minority of R. in the third generation referred to above, produces entirely the R. variety and their progeny are divided into another generation of R., among which are those that will hibernate, and the nymphs and pronymphs of July and August. These and the other nymphs and pronymphs produce the winged sexuparae, which fly between 2 and 5 p.m. and lay eggs on the vine-stocks, producing both males and females. These pair, and four days later the females hide under the bark and, after 24 hours, lay their winter eggs. The whole cycle then begins again. On the European vine, the larva which emerges from the wintering egg with G. characters is unable to produce the gall in which the eggs are to be laid to provide for the aerial generation. Grassi has shown that it is unable to descend to earth and take on R. characters, so that the multiplication of *Phylloxera* on European vines can only take place through the R. type when both varieties of vine are available. The sexuparae oviposit on the American and not on

the European vine. *Phylloxera* may be spread by agricultural implements, by man, by plants grown between the vines, by poultry and domestic animals, by manure and seeds of all kinds, as well as by vehicles. *Clysia ambiguella*, *Euxoa* (*Agrotis*) *tritici*, *Byctiscus betulae* (*Rhynchites betuleti*), *Tetranychus telarius* and *Anomala vitis* are briefly dealt with and the usual remedies are stated.

TAVARES (J. S.). **A *Anastrepha serpentina*, Wiedm., nova praga dos frutos no Brazil.** [*Anastrepha serpentina*, Wiedm., a new pest of fruits in Brazil.] —*Broteria*, *Braga*, xiii, no. 1, 1st February 1915, pp. 52–54.

Anastrepha serpentina, Wied., has been discovered attacking fruit in Brazil and must be added to the pests already known there, viz. :— *Anastrepha fraterculus*, Wied., *Ceratitis capitata*, Wied., and *Lonchaea aenea*, Wied. It attacks the fruit of *Achras sapota*, Mill., (the sapodilla plum). The life-cycle of this fly occupies about a month and a half, the larval period lasting about 30 days, while the pupal stage lasts about 15 days.

SCHNEIDER-ORELLI (O.). **Versuche über Blutlausbekämpfung.** [Studies in Woolly Aphis control.] —*Schweiz. Ztschr. Obst- u. Weinbau*, *Frauenfeld*, xxiv, no. 3, 8th February 1915, pp. 38–41.

In summer and autumn, the newly hatched young of *Eriosoma* (*Schizoneura*) *lanigerum* (the woolly aphis) migrate, preferably to the young shoots and then occupy the entire top of the tree. At first it is not possible to see them with the unaided eye, as they lack the white, waxy covering, and only a few are destroyed if scrubbing is the method of control practised. Thorough spraying with a good, high-pressure sprayer is preferable. The following conditions are necessary for success : The liquid must penetrate the waxy coat, it must speedily kill the Aphids with which it comes in contact, its cost must be low and it must not injure vegetation. In the trials reported, tall apple trees were carefully sprayed with a high-pressure Vermorel sprayer and branches were then cut off and taken to the laboratory, where those treated with a 3 per cent. solution of soft soap remained free from infestation for months. This solution cost less than 1s. 1d. per 20 gallons, it immediately destroyed the waxy coat, all Aphids were killed, and no injury was caused either to the apple foliage or to plants, such as strawberries, growing beneath the trees. Various samples of soft soap all gave the same satisfactory result.

de BERGEVIN (E.). **A propos de *Aelia triticiperda*, Pomel, (Hemipt. Pentatomidae), fléau des céréales.** [*Aelia triticiperda*, Pomel, a pest of cereals.] —*Bull. Soc. d'Hist. Nat. Afrique Nord, Alger*, vii, no. 2, 15th February 1915, pp. 18–23.

The author considers that *Elia triticiperda*, Pomel, and *Pentatoma triticum*, Malméjac, are the same species and probably conspecific with *A. cognata*, owing to its habits, the density of its colonies and the severe

injury it causes. *A. cognata* occurs in North Africa on the Mediterranean basin, being found on all Graminaceae on the cultivated high plateaux and on plains of medium altitude.

MOREIRA (C.). **O Bicho da Fructa de Conde.** [The custard apple caterpillar.]—*Chacaras e Quintaes, S. Paulo,* xi, no. 2, 15th February 1915, pp. 105–107, 6 figs.

Anona reticulata, L., (the custard apple) is a favourite fruit in Brazil, but is disappearing in the Federal District and in the State of Rio de Janeiro, owing to insect pests and primitive methods of cultivation. Its chief insect enemy is the caterpillar of the Microlepidopteron *Stenoma* (*Antaeotricha*) *anonella,* Sepp, described in 1852 (Papillons de Surinam, p. 296) as *Phalaena* (*Tinea*) *anonella.* The adults chiefly appear from July to September. The females oviposit on the fruit. On hatching, the larvae bore into the fruit and feed on the pulp. If the fruits are small when attacked, they shrivel and fall; if already of some size, they ripen, although damaged in the infested portion. From a single fruit the author has seen 30 adults emerge. The larval stage apparently lasts about 20 days and the pupal about 12 days. The collection and destruction of all injured and fallen fruit is very necessary. When high prices are obtainable, it will pay to enclose the fruit in bags. Light traps will also be useful. Insecticides are not advisable.

BONDAR (G.). **Praga dos tomateiros.** [A pest of tomato plants.]—*Chacaras e Quintaes, S. Paulo,* xi, no. 2, 15th February 1915, p. 121.

Large numbers of tomato plants in the State of Rio de Janeiro are being destroyed by a Membracid of the genus *Lamproptera,* often found on wild Solanaceae. The proximity of these wild plants is the probable cause of the infestation. A contact poison is necessary and a simple solution of soap, $3\frac{1}{2}$ oz. in 7 pints of water, may be used, either sprayed or poured on the plants.

UVAROV (B. P.). **Вьючный опрыскиватель Платца.** [Platz's pack-sprayers.]—**«Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd,* 16th January 1915, no. 1 (65) and 23rd January, no. 2 (66), pp. 19–22 and 49–51.

The control of *Locusta* (*Pachytylus*) *migratoria,* L., necessitates the spraying of high and thick growths of reeds, *Phragmites communis,* for which purpose it is practically impossible to use horse-drawn sprayers, while knapsack-sprayers give a lot of trouble and are very ineffective. The Stavropol Station therefore carried out, during the summer of 1914, extensive experiments with the Platz pack-sprayer, packed on camels, and it appeared that this sprayer is well adapted for spraying high reeds (over 10 feet high), while it proved also less expensive and more effective, as compared with knapsack-sprayers when used on low reeds. Its effectiveness equalled that of 20 knapsack-sprayers on high and 11 on low reeds.

PADALKA (V.). **Списокъ** TENTHREDINIDAE **собранныхъ въ Лужскомъ уѣздѣ Петроградской губерніи и нѣкоторыя біологическія наблюденія надъ ними.** [A list of TENTHREDINIDAE collected in the Luga district of the govt. of Petrograd and some biological observations on them.]—**«Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd,* xiv, no. 4, 23rd January 1915, pp. 460–472.

This is a list of 108 species of TENTHREDINIDAE and five species of LYDIDAE collected near Luga in the government of Petrograd during several years; the plants on which the insects or their larvae were found are named, and in some cases a more or less full account of the life-history of the insects is given. Amongst those more fully dealt with are: *Emphytus cingulatus*, Scop., which is numerous in the first half of July; 8–10 eggs are laid inside each of the petioles of leaves of strawberries; a description is given of the larva, which had been recorded by Konow as *Cladius difformis*, Panz.; they pass the winter in the soil, in cocoons, pupating shortly before the appearance of the imago.

The eggs of *Pristiphora ruficornis*, Oliv., were found during the first half of May, being deposited along the main and side veins of the lower sides of leaves of *Ribes rubrum* and *R. grossularia*; the eggs are laid in groups of 12–25 and rest on the surface of the leaves; the larvae hatch out at the end of May and feed on the leaves. Between the 6th and 13th July, all the larvae passed into the soil, and pupated underneath the bushes at a depth of about 2 inches. In the middle of July, the imagines of the second generation appeared, the larvae of which totally defoliated the bushes and entered the soil to a somewhat greater depth at the end of August; the larvae winter in cocoons 5–7 mm. long, and pupate 1–2 weeks before the exit of the imago.

The eggs and quite young larvae of *Trichiosoma vitellinae*, L., (*Lophyrus rufus*, Retz.) were found in a pine wood on 25th May on branches of an old pine, on the tip of the shoots of the previous year. The various stages of the larvae are described. After the fifth moult, they proceeded about the middle of June to weave cocoons on the ground, or in some cases on the shoots of the trees; the cocoons are originally white, but after 24 hours take on the colour of the buds of the pines. The imagines appeared about the middle of August. The eggs are laid in groups of 5–8 eggs on each needle, and the winter is passed in the stage.

The larvae of *Cimbex femorata*, L., were frequently found on birch in June, while the adult larvae of the variety, *silvarum*, F., were found on birch in large numbers in July; in August, the larvae weave cocoons, attaching them to the branches and wintering inside them, pupating not long before the issue of the imago. The larvae are largely subjected to attacks by parasites; out of 65 larvae, 11 were infested with parasites, 2 of them being Tachinids.

DINDON (P.) **Культура ранней капусты въ грунту.** [The open ground cultivation of early cabbage.] **Садовая Библіотека** [*Orchard Library*], supplement to **«Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture and Market-Gardening*], *Petrograd,* 1915, 31 pp., 15 figs.

An account of the life-history of, and the remedies for, the

various insect pests of cabbage is given. *Phyllotreta atra* and *Phyllotreta nemorum* are the two species of *Phyllotreta* more commonly found in Russia: against them, dusting early in the morning, when the plants are still covered with dew, with basic slag and Paris green (100 lb. of slag and 1–2 lb. of green) and spraying with Paris green ($\frac{1}{2}$ lb. of green, 1 lb. of lime in about 45 gallons of water, adding paste prepared from 4 lb. of rye-flour) are recommended. The adults of *Ceuthorrhynchus sulcicollis* winter in the earth and appear early in spring, the females ovipositing in holes made with their proboscis in the stems and petioles of the leaves. The larvae penetrate into the core, passing four weeks in the swellings they form, when they emerge and pupate in the earth. Spraying with Paris green is only partially effective, as the larvae remain inside the stem; better results are obtained by shallow reploughing in autumn before the frosts, after the deep ploughing and harrowing. Hand collection of the larvae is carried out by surrounding the plants with a piece of paper with a hole in the middle, enclosing the stem, and shaking the larvae on to it. For the control of *Chortophila* (*Anthomyia*) *brassicae*, the author has successfully used the following method:—As the eggs are laid on the stem near the surface of the soil and the larvae hatch in ten days, ten days after the transplanting of the cabbages the upper layer of earth to a depth of half an inch round the stem is removed, and this spot powdered with caustic lime. The process may be repeated ten days later, by which time, the cabbages will have so far developed as to make the attacks of the larvae harmless. Against *Pieris brassicae*, fumigation was used with fair success: birch tar and petrol with wood shavings, or better, straw waste, etc., being used to obtain smoke; notwithstanding the fumigation, some of the females succeeded in ovipositing and the crushing of the eggs, the hand-picking of the larvae and spraying with Paris green, are the further remedies recommended. Against *Barathra* (*Mamestra*) *brassicae*, the collection and destruction of the eggs and larvae, powdering with basic slag and slaked lime against the larvae and reploughing the fields before the arrival of frosts to destroy the pupae, are recommended. Against *Plutella maculipennis* (*cruciferarum*), more or less success can be obtained by destroying the eggs, spraying with Paris green and by the use of trap crops of rape.

ROGOZIN (S.). **О преимуществахъ мышьяковистой извести передъ всѣми другими инсектисидами.** [On the advantages of calcic-arsenite in comparison with all other insecticides.]—**«Плодоводство.»** [*Fruit-Growing*], *Petrograd*, February 1915, no. 2, pp. 80–93.

The author advocates the use of calcic arsenite for spraying fruit trees [see this *Review*, Ser. A, iii, p. 20] and gives the following recipes for the preparation of this insecticide:—1 lb. of white arsenic and 4 lb. of soda are boiled in about 3 gallons of water in a copper boiler till the whole of the arsenic is dissolved; about 5 lb. of quicklime is then gradually added in small lumps so as to prevent excessive boiling and bubbling of the mixture; when the whole of the lime is added, the boiler is again put on the fire and allowed to boil slightly for one hour; one-sixtieth part of the whole volume is dissolved in about

3 gallons of water for use. The working proportion is therefore 1 lb. of arsenic, 4 lb. of soda, 5 lb. of lime in 180 gallons. Besides being very effective against *Hyponomeuta malinellus*, orchards sprayed with this liquid have been less affected by the fungi, *Fusicladium*, and *Monilia fructigena*, Pers.

IGOLNIKOV (I.). **Примѣненiя сѣры съ табакомъ для уничтоженiя растительной тли и краснаго паучка въ оранжереяхъ.** [The application of sulphur with tobacco for the destruction of plant-lice and red spider in glass-houses.] —**« Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture and Market-Gardening*], *Petrograd*, no. 6, 21st February 1915, pp. 180–182.

The control of aphids and red spider in green-houses by fumigating with tobacco and sulphur, requires careful handling, as otherwise the fumes of the burning sulphur may cause serious damage to the plants. In order to safeguard against this, after fumigation with tobacco has produced a sufficient amount of smoke, a brazier on which some sulphur, in small lumps of the size of a pea, is burning, is carried through the green-house, constantly fanning the fumes the while. For each fumigation, about $\frac{1}{4}$ of a teaspoon of sulphur dropped into the brazier is sufficient. Having been carried once or twice round the house, the sulphur is left to burn out, as far as possible from any plants. By this procedure good results were always obtained without damage to the plants.

The following abstracts are translated from: **« Вѣстникъ Русской Прикладной Энтомологiи.** [*Messenger of Russian Applied Entomology*], *Kiev*, i, no. 6, 1915. By permission of the Editors.

BORODAIEVSKY (P.). *Myelophilus piniperda* and *minor*. —**« Лѣсной Журналъ.»** [*Forestry Journal*], *Petrograd*, 1914, xliv, nos. 6–7, pp. 1065–1067.

The author's observations, conducted in 1913, again confirm that the adults of *Myelophilus minor* and *M. piniperda*, after ovipositing in spring, eat into the shoots of pines. Thus the shoots are damaged by the beetles twice, after emergence before hibernation and again after oviposition and hibernation. The barking of infested and trap trees before oviposition is finished, is therefore recommended.

GOMILEVSKY (V.). **Лѣсной Отдѣлъ на Всероссiйской Выставкѣ 1913 г. въ Кiевѣ.** [The Forestry Section at the All-Russian Exhibition of 1913 in Kiev.] —**« Лѣсной Журналъ.»** [*Forestry Journal*], *Petrograd*, xliv, 1914, no. 1, pp. 86–113.

The following information is given with regard to forest pests in the governments of Kiev and Podolia: The larvae of *Melolontha melolontha* damage the roots of all kinds of trees, but mostly of 2 or 3 years old pine, causing great damage in nurseries. The foresters combat this pest by collecting the adult beetles; thus, in the Staro-Petrovsky Forestry of Kiev about 11 hundredweight of beetles were collected in six days. Measures against *Dendrolimus* (*Gastropacha*) *pini* include the collection of the wintering caterpillars, the

shaking of the caterpillars from the trees, the collection of the pupae and adults, the digging of trenches of various dimensions, in order to prevent the caterpillars from invading still uninfested pine-plantations; the infection of the caterpillars with fungus diseases; the spraying of the trees with Paris green; and lastly sticky belts, the kind of adhesive mostly applied in the forests consisting of birch tar with a mixture of tallow. Trap belts are recommended as the safest and least expensive remedy, but it is important that they should be put on in time. The best adhesive for them is tanglefoot. As regards natural enemies of *D. pini*, the eggs and caterpillars are devoured by many birds, frogs, hedgehogs, bats and by nearly all species of CARABIDAE; the imagines are caught by goat-suckers and owls. Further particulars of useful birds and their protection are given.

KAPPER (O.). **О послѣдствіяхъ поврежденій лѣса монашенкой.** [On the results of damage to forests by *Lymantria monacha*, L.]—**«Лѣсной Журналъ.»** [*Forestry Journal*], *Petrograd*, xliv, 1914, no. 8, pp. 1214–1219.

The author discusses the question whether it is necessary to fell all trees after they have been injured by *Lymantria* (*Ocneria*) *monacha*. He concludes that forests, so damaged, must be divided into areas according to the degree of injury done. The most injured area must be cut during the first winter. Next year, should the second area not recover in accordance with expectations, it must be felled as well. Whether a forest must be felled or not depends on the locality, the density of the plantation and on the kind of wood. A forest on an elevated spot can recover, if one-third of the needles remain and in a low-lying locality, if one-fourth of them survive. Firs suffer more than pines from *L. monacha*. A forest injured by this pest and cut down not later than the 1st July of the next year, does not lose its value as timber, the durability of which is, if anything, increased.

KRAINSKY (S.). **Вредители садоводства и мѣры борьбы съ ними въ Кіевской губерніи.** [Pests of Horticulture and methods of controlling them in the govt. of Kiev.]—**«Садоводъ и Огородникъ.»** [*Horticulture & the Market-Gardener*], 1914, ii, no. 18, pp. 329–339, no. 19, pp. 358–361, no. 20–21, pp. 379–385, no. 22, pp. 407–412, no. 23, pp. 423–430, no. 24–25, pp. 436–458.

This work gives an account of insect pests in the government of Kiev. It is stated that up to 1907 the population had no idea of the value of spraying and that only in a few of the largest privately-owned orchards were sprayers utilised. The necessity arose of organising bodies of official horticulturists who would, by carrying out work in the peasant orchards, assist in the spread of accurate knowledge amongst the population as to measures against pests. The existence of these bodies travelling round the country made it possible to obtain records of the pests concerned. In 1907, *Malacosoma neustria*, *Aporia crataegi*, *Anthonomus pomorum*, *Pteronus ribesii* (*Nematus ventricosus*) and *Aphis pomi* (*mali*) were the most injurious pests in orchards, and to a less degree, *Euproctis chrysorrhoea*, *Lymantria dispar*, *Vanessa*

polychloros, *Rhynchites pauxillus*, *Hyalopterus pruni* and *Lepidosaphes ulmi*. Pests of market-gardens were *Pieris brassicae*, *P. rapae*, *Phyllotreta nemorum*, *P. atra*, *P. undulata*, *Platyparea poeciloptera* and *Gryllotalpa gryllotalpa*. In 1908, the caterpillars of *M. neustria* were largely infested with Tachinids, while *Aporia crataegi* was considerably checked by an outbreak of flacherie among the caterpillars. Other pests were :—*Choreutis parialis*, *Hyponomeuta malinellus*, *Aegeria* (*Sesia*) *tipuliformis*, *Epicometis hirta*, *Eriocampoides limacina* (*Eriocampa adumbrata*), *Psylla pyri*, and *Aphrophora spumaria*, the last-named having injured strawberries. Fruit trees in the Kanaievsk district were damaged by *Scolytus rugulosus*, which is more common in the government than *S. pruni*. Damage to market-gardens was also done by *Barathra* (*Mamestra*) *brassicae*, *Phyllotreta flexuosa*, *P. vittula*, *Ceutorrhynchus sulcicollis*, *Baris* (*Baridius*) *lepidii*, *Crioceris asparagi*, *C. duodecimpunctata*, and *Anthomyia radicum*. In 1909, additional pests were *Cheimatobia brumata*, *Zeuzera pyrina*, *Cossus cossus*, *Cydia pomonella*, *Rhynchites bacchus*, *R. auratus*, *Anthonomus rubi*, *Balaninus nucum*, *Sciaphobus* (*Sciaphilus*) *squalidus*, *Phyllopertha horticola* and *Macrosiphum cerasi*[in a note, the author of the abstract says that it is not clear what species is indicated by this name], *Aphis ribis*, *Eulecanium* (*Lecanium*) *robiniarum*, *Eriophyes pyri*, *Eriophyes* (*Phytoptus*) *vitis*, *Hylotrupes bajulus*, *Agrilus* sp., *Rhodites rosae*, *Blaniulus* (*Julus*) *guttulatus*, which injured strawberry fruit, *Phytometra* (*Plusia*) *gamma*, *Polia* (*Mamestra*) *pisi*, *Phyllotreta cruciferae*, *P. nigripes*, *Bruchus pisorum* (*pisi*), *B. lentis*, *Chortophila brassicae*, and *Fannia* (*Anthomyia*) *canicularis*. In 1910, *Scolytus rugulosus* and *S. pruni* were more numerous ; trees were also injured by *Aegeria* (*Sesia*) *myopaeformis*. *Rhynchites cupreus* attacked plum trees, which were also injured by *Cydia* (*Grapholitha*) *funebrana*, *Hoplocampa fulvicornis*, *Byturus tomentosus*, *Coleophora hemerobiella*, *Typhlocyba rosae* and *Eriophyes mali*. *Hyponomeuta malinellus* was more common and was greatly infested with the Chalcid, *Ageniaspis fuscicollis*. Other pests of horticulture, noticed in that year, were : *Porthesia similis*, *Byctiscus betulae* (*Rhynchites betuleti*), *R. giganteus*, *Anthonomus rubi*, *Phyllobius contemptus*, *P. oblongus*, *Otiorrhynchus ligustici*, *Neurotoma flaviventris* (*Lyda pyri*), *Dolycoris* (*Pentatoma*) *baccarum*, *Sehirus bicolor* and *Apterona crenulilla* (*Psyche helix*). In market-gardens, *Cassida nebulosa* and *Hylemyia antiqua* were additional pests. A new pest in 1911 was *Xyleborus dispar*, which appeared in large numbers in the district of Kiev. *Lethrus apterus*, *Eriophyes mali*, *E. ribis*, *Abraxas grossulariata*, and *Aspidiotus ostreaeformis* were also numerous. Regarding *Xyleborus dispar*, the author expresses the belief that *Monilia candida*, a fungus which serves as food for the larvae of this species in its galleries, is carried by the adult beetles. In the same year, *Sitones lineatus* and *Apion pisi* occurred in market-gardens, the latter being injurious in pea fields. In 1912, pests not before mentioned, were *Hyponomeuta variabilis*, *Psylla mali* and *Tingis pyri*. Information as to remedies tested is given, including Paris green, sticky belts, djipsin, barium chloride, carbolineum Avenarius, kerosene emulsion, quassia decoction and scalecide. Experiments on utilising Tachinids and Hymenopterous parasites (*Pimpla* sp.) for the control of *Malacosoma neustria* and *Hyponomeuta malinellus* are also shortly reported.

Kulezycki (J.). **Choroby i szkodniki buraków cukrowych.** [Diseases and pests of sugar-beet.]—*Rolnik i Hodowca.* [*Agriculturist & Stock-breeder*], 1914, no. 23, pp. 265–267, no. 24, pp. 279–281.

Remedies for the following insect pests which are frequently injurious to sugar-beet in Poland are given: *Melolontha melolontha* (*vulgaris*), *Bothynoderes* (*Cleonus*) *punctiventris*, *Aphis rumicis* (*papaveris*) and *Agriotes lineatus*.

Polovnikov (P.). **Нѣсколько словъ о мѣрахъ борьбы съ майскимъ хрущемъ.** [A few words on the methods of controlling *Melolontha.*]—**«Лѣсной Журналъ.»** [*Forestry Journal*], *Petrograd*, 1914, xliv, no. 2, pp. 213–216.

The author considers that the remedies recommended at present against *Melolontha* in forests, are often not practicable and frequently fail to attain their object. He emphasises the importance of studying the control of this pest by means of fungi and bacteria.

Pnycrywk do spossbu zucia sreliuika i do zwalerania tejplagi. [On the question of the biology of *Hylobius abietis*, L., and the control of it.]—*Gazeta Lesna i Mysliwska.* [*Forestry & Hunting Gazette*], 1914, no. 5, p. 110.

Smearing young seedling pines, when planting them out, with a mixture of 5 gals. of milk of lime with 3 quarts of linseed oil, is recommended. This should be done twice, in April and July. The laying out of pieces of pine wood as traps, has proved more effective than setting up trap poles.

Chmielewski (Z.). **Nowy sposób tępienia jaj motyli.** [A new method of destroying eggs of Lepidoptera.]—*Rolnik i Hodowca.* [*Agriculturist & Stock-breeder*], 1914, no. 23, p. 273.

4 lb. of Iceland moss (*Citaria islandica*) are boiled for one hour in 20 gallons of water, gradually adding more to maintain a constant volume. With this solution the trees must be carefully sprayed.

W. S. **Labezpiecrenie rozsady kapuścianej od pelity wiemnej.** [The protection of transplanted cabbage from flea-beetles.] *Rolnik i Hodowca.* [*Agriculturist & Stock-breeder*], 1914, no. 21, p. 250.

Against flea-beetles, spraying transplanted crops with the following composition is recommended—5 lb. of tobacco extract, 2½ lb. of slacked lime, 1¼ lb. of copper sulphate and 2½ lb. of quassia or decoction, in 250 gals. of water.

Dementiev (A.). **Къ вопросу о внутренней терапіи растеній.** [On the question of the internal therapy of plants.]—**Журналъ Опытной Агрономіи.»** [*The Journal of Experimental Agronomy*], *Petrograd*, 1914, vol. xv, no. 4.

The author has carried out experiments on introducing various poisonous solutions into plants through cuts made in the roots, the petioles and leaves for the purpose of controlling pests. Many insects

are monophagous, which fact probably depends upon physiological conditions, and therefore the smallest change in the juices of the plants may have a profound effect upon them. The author began his experiments as long ago as 1903, without being aware of the work of Mokrzecki, Shevirev and Berlese. Latterly, he has worked out a simple method of introducing solutions into plants: a rubber tube is placed on the cut surface and is connected with an ordinary Esmarch cup, filled with the solution, suspended on the tree; the fluid penetrates into the cut by the suction produced by the transpiration of the tree. In this way, the author succeeded in introducing enormous volumes of liquid into plants. Thus, in 29 hours, $10\frac{3}{4}$ litres of a solution of arsenic acid in water (1 : 500) were introduced into an apple tree. The speed of the absorption depends directly on the diameter of the branch experimented on and on the degree of rapidity with which the leaves evaporate the liquid; it also varies with the species of plant and with the liquid used. Colloids are hardly absorbed at all and crystalloids vary greatly in their rate of absorption. Salts of alkali metals, especially chorides, are the most rapidly absorbed, those of alkali earths less rapidly. Sulphates are absorbed more slowly than chlorides, while carbonates are absorbed the least. In order to increase the speed of the entry of liquids into plants, introduction under increased pressure was tried. It appeared that fruit trees and vine-stocks stand, without injury, the introduction of liquids under a pressure of up to eight atmospheres. Experiments were made on destroying *Eriosoma* (*Schizoneura*) *lanigerum* by means of introducing barium chloride (1 : 350) and potassium arsenite (1 : 350) into apple trees through the roots. In 1903, the solutions were introduced on 29th July and the examination of the trees on 7th August showed that the white covering of the aphids had disappeared, while the aphids themselves had practically perished. After another introduction on 7th August of 1·6 grm. barium chloride in 800 cc. of water the lice had totally disappeared on 3rd September. The experiments of 1909 produced a decrease in the number of aphids, while their total disappearance was effected only in 1910. The experiments of 1912 on four trees resulted in the total destruction of the pest on one eight-year old tree, which received one-third grm. of barium chloride (1 : 1,000). For trees 20 years old, a dose of up to 1 grm. of barium chloride proved insufficient. How long the effect of the insecticide lasts is uncertain, but it is not limited to one year. Potassium arsenite and arsenic acid proved to be very poisonous to trees, barium chloride less so. Experiments in thus protecting vine-stocks from *Phylloxera*, have not yet given any definite results.

Krassilstchik (I. M.). **Отчетъ о дѣятельности Біо-Энтомологической Станціи въ 1914 году.** [Report on the work of the Bio-Entomological Station (of Bessarabia) during 1914.] Published by the Zemstvo of the govt. of Bessarabia, Kishinev, 1915, 49 pp.

Though *Clysia ambiguella*, Hb., occurred in large numbers in Bessarabia in 1912 and 1913, causing serious damage in 1914, it was little in evidence, probably owing to the vineyards being largely affected by mildew (*Plasmopara viticola*) which attacked

both the vine blossom and grapes. *Melolontha melolontha* was also abundant during 1912–1914, attacking vines and maize; these attacks frequently occurred after the vineyards or fields were cleared of weeds frequented by the pest. *Eriosoma* (*Schizoneura*) *lanigerum*, Hausm., was discovered in 1914 in many new places. The south-western corner, the district of Izmail, along the Rumanian frontier is the most affected, and it is thought that the pest has invaded Bessarabia from Rumania. Spraying is recommended late in autumn, in winter, or early in spring, with a 7–8 per cent. solution of kerosene emulsion in warm water, to which soft soap is added in the proportion of about half an ounce for each pound of kerosene. This spray cannot be used after the middle of May, as the leaves may be scorched, and if undertaken in the first half of May, not more than 4 per cent. of kerosene must be used. If the trees have been infested for a long time and the aphids have already established themselves on the roots or base of the trunk, the latter, as well as the thicker roots, must be uncovered and watered with 4 per cent. solution of potassium sulphocarbonate in water, using 8–11 gallons of the solution for each tree; after this, the roots are again covered, the earth is trodden down and another 2–7 gallons of the solution poured on it. The sulphocarbonate may be replaced with milk of lime, with which the trees can also be sprayed in the absence of kerosene. The fruit-growing districts of Bessarabia suffer also from various species of COCCIDAE, such as *Aspidiotus ostreaeformis*, Curt., *Eulecanium* (*Lecanium*) *cerasi*, *Lepidosaphes ulmi*, L., (*Mytilaspis pomorum*, Bouché), etc. *A. ostreaeformis* winters on the bark of the trunk and branches, partly in the larval stage and partly more or less mature females, which are all viviparous. *E. cerasi* winters, in the larval stage, on branches near the wintering buds and also on fallen leaves, from which it migrates in spring to the trees. *L. ulmi* winters on the bark of the trunks and branches in the egg stage, covered with the shield of the mother. As remedies against these pests, the author suggests spraying with a mixture of sulphur and lime, which can be prepared in either of the following ways:—(1). 10 lb. of lime is slaked in 1½–2 gals. of hot water in a wooden barrel and 10 lb. of flowers of sulphur is then gradually added and the whole stirred up till a homogeneous yellowish-grey substance is obtained; 4½–5 gals. of cold water is then added and stirred for five minutes, after which more cold water to make up a total of 27 gallons of water is gradually added, stirring the while; this mixture must be applied early in spring before the unfolding of the buds; where leaves have already formed on the tree, it must be diluted by adding another 27–30 gallons of water. (2). The slaking of the lime and the addition of the sulphur is done as above, but in an iron pot or some suitable clay vessel, after which 3–4 gallons of hot water is added and the whole boiled on the fire for about one hour, when it turns an amber-yellow colour; when the liquid has cooled down, it is strained into a wooden barrel, containing some 3–4 gallons of cold water, stirring all the time, and then more cold water to a total of 27 gallons is added; the liquid prepared in this way is more drastic in its action than the other and can be only applied to trees without leaves. California mixture is prepared in the same way, but the 3 or 4 gallons of water added after the mixing of the sulphur and lime contain 10 lb. of ordinary salt dissolved in it.

Hoplocampa (*Selandria*) *fulvicornis*, Klug, has done great damage to plum trees; the larvae injure one plum after another, those which fall to the ground with the fruits returning and attacking others. Pupation takes place in the earth, the cocoons lying round the trees at a depth of 3 to 7 inches. This time affords the best opportunity for combating the pests, and experiments have so far shown that the introduction into the soil round the trees of lumps of lime, followed by watering with hot water, leads to the destruction of 60–70 per cent. of the cocoons; the first 3 inches of the soil, which contains practically no cocoons, is previously removed; experiments on the introduction into the soil of carbon bisulphide or potassium sulphocarbonate are not yet concluded. The necessity of combating *Aporia crataegi* and *Euproctis chrysorrhoea* by removing their winter nests is referred to; the collected nests should be kept in a room so that the parasites have an opportunity of escaping. *Cheimatobia brumata* was more than usually injurious in some orchards, attacking all fruit trees and many forest trees. The use of belts are recommended, smeared with tangle-foot or an adhesive prepared from three parts by weight of castor oil, in which five parts of resin is dissolved (this preparation remains tacky only for about two weeks); this should be applied during the second half of October, and later, when the females ascend the trees to oviposit. Plums suffered seriously at the end of April from *Coleophora* sp., both the unfolded blossoms and leaves being devoured; the Station is experimenting on the effects of lime-sulphur and of California mixture on these pests. *Sciaphobus* (*Sciaphilus*) *squalidus*, Gyl., and *Anthonomus pomorum*, L., were also numerous during the year under report. *Lema melanopa*, L., did great damage to barley in some localities; experimental spraying with Paris green (minimum 1 oz. in 3 gals water) and lime gave good results, but it is pointed out that, as both the leaves of barley and the larvae themselves are covered with a sticky matter, the addition of lime and of water is quite unnecessary, and instead of a liquid insecticide, the powder may be dusted on the crop. Winter-sown rape has been attacked by many insects, but chiefly suffered from a weevil, *Baris chloris*, F., the larvae of which mostly fed inside the stems of the plant, but were also occasionally found in the roots. As the larvae are mostly inside the stems in May, trap crops of rape are recommended on infested fields. In the district of Orgeiev, rape has also suffered from *Meligethes aeneus*, F., the females of which began to oviposit on the flower buds at the end of April and early in May. Experiments in spraying with Paris green ($\frac{1}{2}$ oz. of green and $2\frac{1}{2}$ oz. of slaked lime in 3 gallons of water) in April, before the blossoming, gave varying results, depending on the amount of the insecticide used, and owing to the difficulty of getting the liquid to penetrate the close masses of buds. Maize was damaged by *Pyrausta nubilalis* (*Botys silacealis*), but *Phlyctaenodes sticticalis*, L., occurred in 1914 in smaller numbers than in the previous two years. Tests of various insecticides were made at the Station. Urania green in the proportion of about $\frac{1}{2}$ oz. in 3 gals. water produced in the first three days a death-rate of 36 per cent. of caterpillars of *Papilio podalirius*, rising to 96 per cent. in the next two days; this slow action is the only disadvantage of this insecticide. English purple also proved very effective; in the proportion of $\frac{1}{2}$ oz. of purple and 1 oz. of slaked lime

in 3 gals. water, it gave on the first day a death-rate of 10 per cent. of caterpillars of nettle moth, rising gradually to 100 per cent. in five days, whilst, at double strength, the death-rate on the first day was 100 per cent. The budget of the Station in 1913 amounted to £1,186, of which £1,030 were contributed by the Department of Agriculture.

KOLOSSOV (J. M.). **Очеркъ о вредителяхъ полей и лѣсовъ Урала.** [Review of the pests of field crops and forests of the Ural.]—**«Записки Уральскаго Общества Любителей Естествознанія.»** [*Bulletin de la Société Ouralienne d'Amis des Sciences naturelles*], *Ekaterinburg*, xxxiv, no. 11–12, 1915, pp. 133–164.

The information contained in this Review has been compiled from replies to a circular letter sent out during the first half of 1914 by the Ural Society of Friends of Natural Science, the replies covering many localities in the governments of Orenburg, Perm, Ufa, Vjatka, and the province of Turgai. ACRIDIIDAE were reported from nearly all the governments; they are a serious danger in Orenburg and Turgai, much damage having been done by them in both areas.

Mayetiola (*Cecidomyia*) *destructor*, Say, is recorded from Ufa and Perm, where it appears to attack rye in spring, the pupae being found in autumn in the leaf-sheaths and the imagines hatching out at harvest time. *Oscinella* (*Oscinis*) *frit*, L., causes serious damage in many places, probably in company with *Chaetocnema aridula*, Gyl., in Ufa. *Euxoa* (*Agrotis*) *segetum*, Schiff., is widely spread; the caterpillars do great damage to young rye, and in August, September and even later in warm weather, they injure winter crops. The protection of the natural enemies of these pests is suggested, such as *Carabus nemoralis*, Müll., *C. cancellatus*, F., *C. granulatus*, L., and TACHINIDAE. The other pests of field crops reported, are: *Sitones lineatus*, L., probably also *Sitones crinitus*, Ol. and *S. sulcifrons*, Thunb., and *Macrosiphum* (*Siphonophora*) *pisi*, Kalt. Forest pests included: *Hylobius abietis*, L., *Melolontha hippocastani*, F., the Longicorn, *Acanthocinus aedilis*, L., and SCOLYTIDAE; the moths, *Cossus cossus* (*ligniperda*), *Malacosoma* (*Lasiocampa*) *neustria*, *Dendrolimus* (*Gastropacha*) *pini*, L., *Lymantria* (*Ocneria*) *dispar*, L., *L. monacha*, L., *Bupalus piniarius*, L., and *Panolis piniperda*, Panz., *Hyponomeuta padi*, Zett., and the sawfly, *Lophyrus pini*, L. *Gryllotalpa gryllotalpa*, L., injured 13 acres of forest in the district of Ekaterinburg. Orchards in some localities of the government of Orenburg have suffered from *Aporia crataegi*, L.

SACHAROV (N.) & SHEMBEL (S.). **Отчетъ о дѣятельности Энтомологической Станціи и микологическаго отдѣленія за 1914 годъ.** [Report on the work of the Entomological Station and of the Mycological Branch in 1914.] Published by the Entomological Station of the Astrachan Society of Gardening, Market-Gardening and Field-cultivation, Astrachan, 1915, 162 pp.

An account of the work done by the Station during 1914 is given with reference to studies on insect pests and experiments with insecticides, etc. A list of insect pests noticed during the year includes:—*Eriophyes pyri*, Pagst., *E. vitis*, Land., *Tetranychus telarius*, L., *Gryllotalpa gryllotalpa*, L., *Tingis pyri*, Geoffr., *Aphis pomi*, de G., *Myzus*

cerasi, F., *Myzus ribis*, Buckt., *Aphis brassicae*, L., *A. idaei*, Goot, *A. pyri*, Koch, *Hyalopterus arundinis*, F. (*pruni*, F.), *Aphis crataegi*, Kalt., *A. gossypii*, Glov., *Lepidosaphes ulmi*, L., (*Mytilaspis pomorum*, Bouché), *Psylla pyricola*, Först., *Hyponomeuta malinellus*, Zell., *H. variabilis*, Zell., *Plutella maculipennis*, Curt., (*cruciferarum*, Zell.), *Cydia pomonella*, L., *Eucosma* (*Tmetocera*) *ocellana*, F., *Polychrosis botrana*, Schiff., *Cossus cossus*, L. (*ligniperda*, F.), *Zeuzera pyrina*, L., *Talis quercella*, Schiff., *Pieris brassicae*, L., *P. rapae*, L., *P. daplidice*, L., *Malacosoma neustria*, L., *Biston hirtarius*, Cl., *Lymantria* (*Ocneria*) *dispar*, L., *Euproctis chrysorrhoea*, L., *Phytometra* (*Plusia*) *gamma*, L., *Euxoa segetum*, Schiff., *Barathra* (*Mamestra*) *brassicae*, L., *Agriotes lineatus*, L., *Epicauta erythrocephala*, Pall., *Opatrum sabulosum*, L., *Colaphus sophiae*, Schall., *Entomoscelis adonidis*, Pall, *E. dorsalis*, F., *Phyllotreta cruciferae*, Goeze, *P. atra*, F., *P. nemorum*, L., *P. undulata*, Kytsch., *Anthonomus pomorum*, L., *Byctiscus betulae*, L., (*Rhynchites betuleti*, F.), *R. auratus*, Scop., *R. bacchus*, L., *R. aequatus*, L., *Scolytus* (*Eccoptogaster*) *rugulosus*, Ratz., *S. pruni*, Ratz., *Melolontha hippocastani*, F., *Polyphylla alba*, Pallas, *Epicometis* (*Tropinota*) *hirta*, Poda, *Oxythyrea stictica*, L., *Pristiphora* (*Nematus*) *appendiculata*, Hbst., *Eriocampoides limacina* (*Selandria adumbrata*), Klug, *Athalia spinarum*, F.

The campaign against locusts was conducted by the Local Board of Agriculture, the author having only actually conducted operations on a small plot of 108 acres, the cost of which amounted to about £20. The author adds the following insects to his "Report on Injurious insects noticed in the government of Astrachan during 1912–1914" [see this *Review*, Ser. A, iii, p. 219]: *Eriophyes ribis*, Nal., on leaves of black and red currants; *Aphis laburni*, Kalt., yearly in large numbers on white acacia; *Aulacaspis* (*Diaspis*) *rosae*, on roses; *Hyponomeuta rorellus*, Hb., attacking *Salix* exclusively; *Dermestes lardarius*, L., common in stores; its larvae were noticed during the summer of 1914 in the nests of *Hyponomeuta malinellus* and *H. variabilis*, feeding on the pupae and caterpillars; *Calandra oryzae*, L., in stores of buckwheat; and *Rhizotrogus solstitialis*, L.

D. M. K. **Напоминаніе садовладѣльцамъ.** [A reminder to horticulturists.] **«Извѣстія Московской Губернской Земской Управы.** [*Bulletins of the Uprava* (*Executive*) *of the Zemstvo of the govt. of Moscow*], *Moscow*, nos. 1–2, January-February 1915, pp. 33–35.

The removal of winter nests of *Aporia crataegi* and their destruction before the larvae have issued, are strongly urged; when this opportunity has been missed, spraying with Paris green is recommended; sticky belts must be used in order to protect trees against the larvae which may come from neighbouring orchards.

Sevastianov (I.). **Бацилла** d'Herelle **или мышьякъ нужны въ борьбѣ съ саранчей?** [Whether the bacillus of d'Herelle or arsenic is necessary to control locusts.]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*]. *Tashkent*, no. 2, February 1915, pp. 151–171.

An account is given of the results obtained by the use of *Coccobacillus acridiorum* both abroad and in Russia, and the failure of this

method in Algeria, South Africa, Stavropol and Bokhara is pointed out. The chemical method, both spraying operations and the use of poisoned baits, is recommended. A list of 22 books and articles on the subject, of which nine are in Russian, is appended.

Dindon (P. J.). *Cyclamen persicum giganteum.*—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, 1915, no. 2, February, pp. 100–104,

Cyclamens are attacked by Aphids and *Thrips haemorrhoidalis*, the latter appearing at any time during the year, if the plants are neglected. To destroy these pests, fumigation with tobacco smoke or dipping the plants into soapy water for about a minute and washing them afterwards with clean water, is effective.

Kamber (A.). **Зимнія работы въ плодовомъ саду.** [Winter work in orchards.]—**«Наше Хозяйство.»** [*Our Husbandry*], *Eletz*, no. 2, 12th February 1915, pp. 8–9.

The necessity for the removal and destruction of the nests of *Aporia crataegi* and *Euproctis chrysorrhoea* is insisted on, and it is pointed out that this is best done when the ground is covered with snow, as then the fallen nests are less likely to escape notice.

Отчетъ Энтомологическаго Бюро за 1913 г. [Report of the Entomological Bureau of the Zemstvo of the govt. of Charkov for 1913.] Published by the Zemstvo of the govt. of Charkov, *Charkov*, 1915, 95 pp., 10 tables of figs.

The Report contains, besides a general review of the work of the members of the Bureau, the following separate articles :—

Averin (V. G.), **Обзоръ вредителей, наблюдавшихся въ Харьковской губ. за 1913 годъ.** [Review of the pests noticed in the govt. of Charkov during 1913], pp. 10–65, tables I–VI.

Investigations into a great variety of insects and their parasites showed that the caterpillars of the following Lepidoptera were entirely free from parasites :—Butterflies, *Papilio machaon*, L., *P. podalirius*, L., *Pieris daplidice*, L., *Melitaea didyma*, O. ; Moths, *Pygaera curtula*, L., *P. anachoreta*, F., *Malacosoma castrensis*, L., *Saturnia spini*, Schiff., *Drepana falcataria*, L., *Scotogramma* (*Mamestra*) *trifolii*, Rott., *Scoliopteryx libatrix*, L., *Ennomos quercinaria*, L., *Hygrochroa syringaria*, L., *Zygaena scabiosae*, Z., and *Pachytalia* (*Psyche*) *unicolor*, Schiff. Hymenopterous parasites were found in 47 species of insects, the percentage of infestation reaching frequently 95–100 per cent. and being usually 40–50 per cent. Dipterous parasites were found in 24 species, the usual percentage of infestation being much lower than that of Hymenoptera, although it also reached 100 per cent. in some cases ; fungi and bacterial diseases were noticed in 41 species. In the case of *Phlyctaenodes sticticalis*, though it suffered from the attacks of both Hymenopterous and Dipterous parasites, as well as fungi and bacterial diseases, only a total death-rate of 12 per cent. from all these causes was recorded. Hymenopterous parasites showed the highest percentage of infection in the following insects :—*Cionus scrophulariae*

100 per cent.; *Angerona prunaria*, L., 100 per cent.; *Pyrameis cardui*, 100 per cent.; *Acronycta tridens*, Schiff., 86 per cent.; and *Eurygaster integriceps*, Put., 80 per cent. Dipterous parasites specially infested: *Trichiocampus* (*Cladius*) *viminalis*, Fall., 100 per cent.; *Tipula oleracea*, L., 100 per cent.; *Sphinx ligustri*, L., 74 per cent.; and *Orgyia antiqua*, L., 70 per cent.

The following pests are reported:—Arachnoidea: *Tetranychus telarius*, L. *Eriophyes ribis*, Nal., on black currants and *E. pyri*, L., which occurs over the whole government.

Insecta:—Orthoptera: *Locusta* (*Pachytylus*) *migratoria*, L., *Calliptamus* (*Caloptenus*) *italicus*, L., *Chorthippus* (*Stenobothrus*) *pulvinatus*, F.-W., *Stethophygma* (*Mecostethus*) *grossum*, L., *Oedaleus nigrofasciatus*, de Geer, *Tettigonia* (*Decticus*) *verrucivora*, L., *Phasgonura* (*Locusta*) *viridissima*, L., *Onconotus laxmanni* and *Gryllotalpa gryllotalpa*, L.

Thysanoptera: *Haplothrips tritici*, Kurd., and *Limothrips denticornis*, Hal., which was specially numerous on fields damaged by the zizel mice (*Spermophilus guttatus*, Temm).

Rhynchota: *Eurygaster integriceps*, Osh., which was attacked by various parasites, including *Telenomus sokolowi*, Mayr, and *T. semistriatus*, Nees, which destroyed 80–90 per cent. of the eggs; a hyperparasite, *Encyrtus* sp., was also present, but its activity was not great; experiments showed that both these species of *Telenomus* can increase parthenogenetically and also infest the eggs of other PENTATOMIDAE; *Eurygaster maurus*, F., and *E. austriacus*, Schrank, were also found, but in smaller numbers; *Eurydema oleraceum*, L.; *Tingis pyri*, F.; the Jassid, *Cicadula sexnotata*, Fall.; *Psylla pyri*, L., and *P. mali*, Först., were not numerous and consequently did no great damage; *Aphis pomi*, de Geer (*mali* F.), was present nearly everywhere in orchards; *Aphis gossypii*, Glov. (*cucumeris*, Forbes) did great damage to bachza plants, but washing with an extract of quassia with soap gave excellent results against it, as well as against *Aphis brassicae*, L.; *Myzus cerasi*, F.; *Macrosiphum* (*Siphonophora*) *pisi*, Kalt., in lucerne fields.

Diptera: *Chortophila brassicae*, Bouché; *Hylemyia antiqua*, Meig.; *Oscinella* (*Oscinis*) *frit*, L.; *Tipula oleracea*, L., injured cabbages but was largely infested with Tachinids.

Hymenoptera: *Cimbex femorata*, L. (*betulae*, Zadd.), frequently found on young birch trees; *Arge* (*Hylotoma*) *berberidis*, Klug, in some localities defoliated bushes of barberry; *Hylotoma rosarum*, L.; *Pteronus* (*Nematus*) *salicis*, L.; *Croesus* (*Nematus*) *septentrionalis*, L.; *Trichiocampus* (*Cladius*) *viminalis*, F., on poplars; *Emphytus grossulariae*, Gl., two generations of which occurred between the end of June and the middle of September, was found both on red and white currants; spraying with Paris green proved very effective; *Lophyrus pini*, L., is very injurious to young (1–8 year old) plantations; crushing the larvae with gloved hands proved very effective; when the numbers are small, spraying with barium chloride (5 lb. in 27 gallons of water) may be used; *Athalia spinarum*, F., injured mustard in the district of Kupjansk; *Eriocampoides limacina*, L., (*Eriocampa adumbrata*, Klug) was found in quantity on cherries; *Ardis* (*Blennocampa*) *bipunctata*, Kl., injured young shoots of roses; *Hoplocampa fulvicornis*, Klug, was found sporadically, some orchards being totally

destroyed, while the plums in neighbouring ones frequently remained untouched: *Hoplocampa testudinea*, Klg., and *Cephus pygmaeus*, L.

Coleoptera: *Sitodrepa panicea*, L., common in stored goods; fumigation with carbon bisulphide gave good results against it; *Lytta vesicatoria*, L., common everywhere, injuring leaves of ash trees; *Lema melanopa*, L., on oats, wheat and barley in several districts, the eggs of the second generation being heavily infested with parasites; *Haltica erucae*, Oliv., *H. oleracea*, L.; *Cassida nebulosa*, L.; *Bruchus pisorum*, L., (*Laria pisi*, L.); *Sciaphobus squalidus*, Gyll; *Bothynoderes* (*Cleonus*) *punctiventris*, Germ.; *Pissodes notatus*, L., on 2–3 year old plantations of pines; the removal and destruction of the damaged trees seems to be the only remedy; *Anthonomus pomorum*, L.; *Apion apricans*, Hbst., on lucerne and clover, with two other species of *Apion*; *Rhynchites pauxillus*, Germ., *R. giganteus*, Kryn., *R. bacchus*, L.; *R. cupreus*, L., *Byctiscus betulae*, L., (*R. betuleti*, F.); on plums; *Lethrus apterus*, Laxm.; *Amphimallus solstitialis*, L., which was preyed upon by *Carabus cancellatus*, Illig., and *C. scabriusculus*, Oliv.; *Melolontha melolontha*, L., and *M. hippocastani*, F.; watering the loose soil with a solution of Paris green in ammonia (azurgreen) proved very effective against the larvae, but strawberries suffered from scorching caused by this insecticide; *Carabus cancellatus*, Illig., has been observed to attack the adults; *Anisoplia austriaca*, Herbst; *A. cyathigera*, Scop., (*crucifera*, Herbst); *Pentodon idiota*, Herbst; *Epicometis* (*Tropinota*) *hirta*, Poda.

Lepidoptera: *Tinea granella*, L., was discovered in stores of biscuits and was almost entirely destroyed by disinfecting with carbon bisulphide; *Lithocolletis populifoliella*, F., injured poplar trees, especially *Populus suaveolens*, Fisch., while silver poplar (*Populus alba*) was injured to a less degree, being particularly attacked by the second generation; willows were also attacked, but in the majority of cases the caterpillars died on these trees without attaining their full growth; according to B. S. Valch, the imagines winter in cracks of the bark, therefore smearing the trees with lime in late autumn or early spring may prove an effective remedy against them; *Hyponomeuta malinellus*, Zell., did great damage in some localities. *Ageniaspis fuscicollis*, Hal., was specially noticeable among its parasites, which included also Tachinids, but the larvae of the latter were themselves attacked by a hyperparasite, *Chalcis femoraria*, L.; *Hyponomeuta variabilis*, Zell. was largely present on black thorn in one district; *Cydia pomonella*, L., occurred everywhere; *Cydia* (*Grapholitha*) *funebrana*, Tr.; *Eucosma* (*Grapholitha*) *ocellana*, F., was injurious to young buds and leaves of apple trees early in May in some localities; *Rhyacionia* (*Retinia*) *buoliana*, Schiff., damaged young pine plantations in the Zmievsk district; an enormous outbreak of *Phlyctaenodes* (*Eurycreon*) *sticticalis*, L., caused damage estimated to exceed £50,000; nearly all crops were attacked, but the caterpillars did not readily eat potatoes, tomatoes or egg-plants and did not touch *Solanum nigrum*; Paris green gave good results, but carbolic emulsion destroyed not only the caterpillars, but also the leaves of cabbage, while the results obtained with barium chloride were conflicting; the second generation of the caterpillars failed to develop, which is attributed to the rainy weather; a certain number of caterpillars of the first generation did not pupate, but remained in a state of diapuse over the winter [see this

Review, Ser. A, i, p. 191, and the two following articles.] *Pyrausta nubilalis*, L., (*Botys silacealis*, Hb.) did considerable damage to maize, 90 per cent. of the stalks being frequently infested; *Phlyctaenodes* (*Botys*) *palealis*, Schiff., injured the flowers of carrots in several localities; the caterpillars entangle the inflorescence in a web and eat the seeds; *Galleria mellonella*, L.; *Pieris brassicae*, L., was numerous; *P. rapae*, L., greatly damaged cabbage and in some localities took the second place after *P. sticticalis* with regard to numbers and the damage done; a large outbreak of *Aporia crataegi*, L., occurred; the caterpillars of the first generation greatly suffered from various parasites, such as *Pimpla instigator* (1 per cent.), Tachinids (7 per cent.), and fungus diseases (pebrine) from which 37 per cent. perished; *Malacosoma neustria*, L., *Lymantria dispar*, L., *Stilpnotia* (*Leucoma*) *salicis*, L., *Euproctis* (*Porthesia*) *chrysorrhoea* all occurred; *Phytometra* (*Plusia*) *gamma*, L., damaged cabbage and beet; *Acronycta tridens*, Schiff., was not injurious, the caterpillars being heavily infested with parasites, which was also the case with *Acronycta psi*, L., *A. aceris*, L., and *A. rumicis*, L.; *Trachea* (*Hadena*) *basilinea*, F., attacked wheat, chiefly the white-eared kind, while "arnautka" (*Triticum durum* v. *hordeiforme*) suffered less; *Oria* (*Tapinostola*) *musculosa*, Hb. was noticed in wheat and on summer-sown crops generally; *Chloridea* (*Heliothis*) *dipsacea*, L.; *Euxoa* (*Agrotis*) *segetum*, Schiff.; *Euxoa tritici*, L.; *Agrotis c-nigrum*, L.; *A. ravida*, Schiff. (*obscura*, Brahm); *A. ypsilon*, Rott.; *Barathra* (*Mamestra*) *brassicae*, L., which was found together with *Polia* (*M.*) *persicariae*, L., *P. pisi*, L., *P. oleracea*, L., and *Scotogramma* (*M.*) *trifolii*, Rott., and others; they damaged beet as well as cabbage; *Episema* (*Diloba*) *coeruleocephala*, L.; *Hylophila* (*Halias*) *prasinana*, L., on oaks; *Arctia caja*, L., a large outbreak of which occurred in one pine forest of the Zmievsk district without doing very serious damage; a great number of the caterpillars were infested with the muscardine fungus; *Diacrisia* (*Spilosoma*) *lubricipeda*, L., was frequently found on cabbage in late summer.

Galkov (V. P.). **Наблюденія надъ массовымъ появленіемъ лугового мотылька въ 1913 г. въ Богодуховскомъ уѣздѣ Харьковской губ.** [Observations on the outbreak in 1913 of *Phlyctaenodes sticticalis*, L., in the Bogoduchovsk district of the govt. of Charkov], pp. 66–78, tables VII–X.

This is an account of investigations in the Bogoduchovsk district, where a large outbreak of *Phlyctaenodes sticticalis* occurred in the year under report. Out of a total of 7,720 acres of beet plantations in the district only 32 per cent. were untouched by the caterpillars, while 8·3 per cent. were destroyed, 21·7 per cent. were seriously and 38 per cent. were more or less damaged. The large numbers of the first generation came to an end in the second half of May and the first caterpillars were noticed on 3rd June and by the 9th July they had all pupated. Heavy rains do not wash the caterpillars off, but continual rain, followed by a drop in the temperature to 18° F., delays their growth and many of them pupate without reaching their normal size. A few instances of observed migrations of the caterpillars are given, evidently occasioned by scarcity of food. Trenches round the plantations were nearly everywhere used as a preventive measure and spraying

with Paris green and barium chloride as a means of actually controlling the pest; but it was necessary to use a 6 per cent. solution of the latter and to apply Paris green in the proportion of 4 lb. of green and 8 lb. of lime in 55 gallons of water, to obtain more or less successful results. The weaker solutions, usually recommended in entomological literature, did not prove effective. These insecticides, at the above strengths, produced a maximum death-rate of 23–24 per cent., but it did not appear practicable to increase the strength, as no better results could be obtained, while more concentrated insecticides affected the leaves of beets. Experiments further showed that azurgin gave a death-rate of from 4 to 12 per cent., kerosene emulsion about 16 per cent., carbolic emulsion about 13 per cent., and tobacco extract, even at a strength of 20 lb. of tobacco in 27 gallons of water, only 3 per cent. Rolling did not harm the caterpillars, but damaged the plants; hand collection, although effective, proved expensive and better results were obtained by drawing between the beds drag-nets made of sail-cloth smeared with tanglefoot, although the apparatus soon became filled with earth and pieces of leaves. Various birds, rooks, crows, jackdaws, larks, and even sparrows greatly assisted the destruction of the caterpillars. The pupal stage lasted 19–21 days and the imagines of the second generation appeared on the beet plantations from 16th–19th July, being somewhat earlier along the edges of forests.

Журналъ Энтомологическаго Совѣщанія по вопросу о мѣрахъ борьбы съ луговымъ мотылькомъ. [Proceedings of the Entomological Conference on the questions of methods of control of *Phlyctaenodes sticticalis*, L. (convened by the Uprava (Executive) of the Zemstvo of the govt. of Charkov and held on 20th June 1913).] *Charkov* 1915, pp. 82–93.

The proceedings began with a report by V. G. Averin on the occurrence of *Phlyctaenodes sticticalis* in the government of Charkov and on the measures undertaken by the Bureau to assist the population in the control of the pest. At the time of the Conference, the danger from the first generation was already over and it was proposed to advise on the measures to be undertaken against the second generation. The discussion showed that in the majority of cases spraying operations were of little avail, but both I. V. Emelianov and S. A. Mokrzecki were inclined to attribute this failure to technical defects. The latter pointed to the good results which he always obtained by spraying with barium chloride [see this *Review*, Ser. A, i, p. 359], and suggested that, besides technical defects, the absence of favourable results may have also been due to spraying having been carried out in rainy weather. In his opinion, the effectiveness of this insecticide depends also upon the age of the caterpillars. The conference adopted a resolution affirming that spraying with insecticides must be regarded as the most effective remedy, if correctly applied, and recommended as subsidiary remedies, covering the plants with earth, trenches round plantations and fields, and the use of tanglefoot.

MOKRZECKI (S. A.). **Филлоксера, ея жизнь по новымъ изслѣдованіямъ, мѣры борьбы съ нею и способы дезинфекціи по садочнаго матеріала.** [*Phylloxera*, its life history according to new investigations, remedies against it and the disinfection of the vine-stock.] Published by the Taurida-Ekaterinoslav Committee of Viticulture and Wine-making, *Simferopol*, 1915, 97 pp. 3 figs., 5 plates.

This is a short review of the history of the importation of, and the campaign against *Phylloxera* in Russia. It was first introduced into Russia between the years 1870-1875 by stocks from Erfurt, imported more or less simultaneously into the Crimea, Caucasia, Transcaucasia and Bessarabia. The first attacks on vineyards by *Phylloxera* were observed in 1880 in the Crimea, but after a campaign lasting 16 years and consisting of the destruction of the pest by injecting carbon-bisulphide or Crolas mixture (carbon bisulphide and kerosene) and by watering the surface with a solution of K_2S_3, followed by digging up and burning the plants, that country was finally freed in 1896. The following eight vine-growing provinces of Russia:—Astrachan, Tchernoie-More, Terek, Dagestan, Elisavetpol, Erivan, Kars and Turkestan, are free from this pest, but of a total of 675,000 acres of vineyards in Russia, 378,000 are infested with *Phylloxera*. The life-history of *Phylloxera*, according to American authors and to the latest investigations of B. Grassi, Grandori and A. Foa, is described. On American varieties of vine, the cycle is a two-yearly one and both the sexuparae and the hibernating eggs are present, while on the European varieties the sexuparae and hibernating eggs are absent, the winged individuals being less numerous and the parthenogenesis of the root forms lasting indefinitely. Enemies of *Phylloxera* mentioned, are:—The larvae of the Coccinellid, *Pullus* (*Scymnus*) *haemorrhoidalis*, which, in Sicily, destroys the eggs and young larvae in the galls, while the imagines prey upon the leaf form; *Coccinella decempunctata* and other species; *Chrysopa perla*; *C. vulgaris*; *Phaneroptera quadripunctata*; *Trombidium holosericeum*, the importance of which is, however, not great. *Drepanothrips reuteri* is found on leaves of vine, although it is not yet established whether it attacks *Phylloxera*. Some predaceous mites have been observed to attack the root form. In a supplement, the Russian law relating to the control of *Phylloxera* and regulating the importation of stocks from abroad is given. An estimate for the construction of a concrete fumigating chamber is also given, the total cost being £42 to £43.

BECK (E.). **Home Correspondence: Winter Spraying.** *Gardeners' Chron., London*, lvii, 6th March 1915, p. 127.

The opinion is expressed that the annual use of alkali wash is injurious to fruit trees, more especially to old ones. The writer advises that the wash be applied once in every three years, and in mid-winter, not in the spring. The importance of cleansing the old wood is emphasised; loose bark should be removed, every piece of decayed wood and trace of canker cut away, and the wounds dressed with gas tar. The stems should be scrubbed thoroughly with strong soft soap and water.

Clayton (J.). **Winter Spraying.**—*Gardeners' Chron., London,* lvii, 6th March 1915, p. 127.

It is stated that a grower who cultivates a large area of apples and pears, has noticed that during the past two years his trees were later in bursting than usual. As this cannot be accounted for by weather conditions, it is attributed to annual spraying with alkali wash.

Stewart (H. J.). ***Cryphalus abietis*, Ratz., in Aberdeenshire.**—*The Scot. Nat., Edinburgh,* no. 39, March 1915, p. 70.

Cryphalus abietis, Ratz., is recorded on silver fir (*Abies pectinata*) from near Aberdeen. Larvae and adults were found in great numbers, the galleries being chiefly in the bark, while the beetles were always found in dead, lopped-off branches. Although numerous spruce trees (*Picea excelsa*) occurred in the neighbourhood, none were attacked.

Webster (F. M.). U.S. Bur. Entom. **Importance of observations on apparently unimportant insects.**—*Canadian Entomologist, London, Ont.,* xlvii, no. 3, March 1915, pp. 69–73.

Stress is laid on the necessity of thoroughly investigating insects and their attacks upon vegetation, regardless of whether they are injurious at the time or not. The author has occasionally been criticised on account of having apparently spent time and funds in studying insects whose attacks were, so far as then known, of little or no importance. These restrictions were not always warranted and the author mentions, from his own experience and that of others working under his direction, the following insects which, when first observed, were either of no economic importance or of which the importance was not then suspected: *Myochrous denticollis* (the southern corn beetle), *Cerotoma caminea*, *Diabrotica 12-punctata*, *Sitones hispidulus* (the clover-root curculio), *Phytometra californica* and *Toxoptera graminum*.

Ainslie (G. G.). **A New Aphid from Florida.**—*Canadian Entomologist, London, Ont.,* xlvii, no. 3, March 1915, pp. 85–88.

Carolinaia cyperi, sp. n., is described. This aphid was first found at Lakeland, Florida, in November 1912. It appears to be rather generally distributed throughout Florida on its only observed food-plant, *Cyperus esculentus*, which, in its wild form, is the troublesome nut-grass of the south and, in cultivation, is known as chufa. *C. cyperi* thrives on chufa in cages and forms colonies on it readily in the field. It lives only on the under side of the leaves, which never seem to show the slightest effect of its presence even in large numbers. When found in November, the colonies, then rather small, consisted of apterous adults, young, and an occasional alate form. In January, almost every plant in the field bore large colonies, but winged adults were very scarce. When transferred to a cage, winged forms appeared at once, indicating that they had been developing, but leaving the parent colony as soon as mature. The large colonies persisted in the field and became very abundant until about the middle of March,

when predaceous enemies began to attack them seriously, *Coccinella sanguinea* and the Syrphid, *Baccha clavata*, being the most important. Numbers of parasites were reared from the larvae and pupae of the predators, among them several undescribed species of Hymenoptera.

ROHWER (S. A.). **Description of a New Seed Chalcid from Spruce.**—*Canadian Entomologist, London, Ont.*, xlvii, no. 3, March 1915, pp. 97–98.

A description is given of *Megastigmus piceae*, sp. n., a Chalcid which has been reared in Colorado by Mr. J. M. Miller from the seeds of *Picea engelmanni* (Engelmann spruce), from *P. sitchensis* (Sitka spruce) and from *P. parryana* (Colorado blue spruce).

GIBSON (A.). **The Asparagus Beetle.**—*Canadian Horticulturist, Peterboro, Ont.*, xxxviii, no. 3, March 1915, p. 69.

The common asparagus beetle (*Crioceris*) injures young shoots of the asparagus. The beetle passes the winter in the mature stage. Poultry, if allowed to run over the beds in spring, will eat large numbers of the larvae. The most effective remedy is dusting the plants every three or four days with fresh, air-slaked lime.

The Control of Orchard Pests.—*Canadian Horticulturist, Peterboro, Ont.*, xxxviii, no. 3, March 1915, pp. 88–89.

The tarnished plant bug (*Lygus pratensis*) appears early in spring and attacks the young fruit of apple and pear trees. The best control is a spray of Black Leaf 40, $\frac{3}{4}$ lb. to 100 gals. water, when the blossoms are falling. The campaign against the San José scale (*Aspidiotus perniciosus*) has had very satisfactory results and has shown the value of the legislation against the importation of infested stock. The green apple aphis (*Aphis pomi*) has been found to produce 14 generations in one season, the life-cycle covering an average of 28 days. The best spray is a mixture of lime-sulphur, 28° Bé., Black Leaf 40 (1–1,500) and flour paste applied at the time of the opening of the flower buds.

TREHERNE (R. C.). **The Insectivorous Habits of the Mole in British Columbia.**—*Agric. Gaz. Canada, Ottawa*, ii, no. 3, March 1915, pp, 216–217.

Wireworms, cutworms, root-maggots, weevil larvae, etc., are readily devoured by the common field mole. *Scapanus townsendii*, Bach, (Townsend's mole) and *Neurotrichus gibbsi*, Baird, (Gibb's mole) are the two species which occur in the Lower Fraser Valley of British Columbia. The latter is the commoner and is the species referred to in this note. During the investigation into the life history of the strawberry root weevil in the Lower Fraser Valley in 1912 and 1913 [see this *Review*, Ser. A, i, p. 92], it was considered that the mole was probably its most important predatory enemy. During an outbreak of *Lycophotia margaritosa* (*Peridroma saucia*), the variegated cutworm,

in the summer of 1914, it was noted that a mole run passed beneath the infested red currant bushes. Infested cabbage and turnip plantations had the same burrows. The animal had moved in practically a direct line from plant to plant at an average depth of from 3 to 6 inches. The burrows had a definite relation to the presence of the larvae. The results of White's recent study of the food of *Talpa europea* (the European mole) are quoted [see this *Review*, Ser. A, ii, p. 706]. It is considered probable that the mole does more good than harm, unless present in exceptional numbers.

Palmer (E. F.). **The Cherry in Ontario.**—*Ontario Dept. Agric., Toronto, Ont.* Bull. 230, March 1915, 40 pp., 16 figs.

Two species of cherry fruit fly, *Rhagoletis cingulata* and *R. fausta*, appear in the adult stage early in June, and feed on the leaves and juice of the ripe fruit. Eggs are laid under the skin of the cherry; the larvae feed on the fruit, and when mature, enter the soil to pupate. The pupal stage lasts until the following June. A spray consisting of 2–3 lb. lead arsenate paste to 40 gals. water, sweetened with 1 gal. molasses, has been found effective. The first application should be made at the beginning of June as soon as the flies appear, the second from 10–12 days later. *Conotrachelus nenuphar*, the plum curculio, deposits its eggs on the green cherry. The larva enters the fruit to feed, and, when mature, pupates in the ground. The adult emerges in from 3–4 weeks, feeding on apples, etc., until winter, when it hibernates under grass or leaves. In spring, it emerges just before the fruit trees bloom. All hibernating places should be removed before winter; spraying with lead arsenate in spring will usually control it. *Eriocampoides limacina*, the pear slug, frequently attacks the cherry. The larvae, of which there are two broods annually, feed on the upper surface of the leaves. The trees should be sprayed with lead arsenate, 2–3 lb. in 40 gals. water, unless the fruit is beginning to ripen. Dusting with hellebore or air-slaked lime will destroy many of the larvae. Aphids attacking young shoots can be controlled by spraying with kerosene emulsion, whale-oil soap or Black Leaf 40, before the buds have burst. A brief account is given of the control of *Aspidiotus perniciosus*, the San José scale. Sour cherries are subject to the attack of *Conotrachelus nenuphar*. Spraying with a mixture of lime-sulphur and lead arsenate has been found satisfactory.

Brown (F. J.). **Insect and Fungus Diseases of Fruit-Trees.**—*Agric. Gaz. New South Wales, Sydney,* xxvi, no. 3, March 1915, pp. 265–266.

One of the worst pests in apple orchards is *Cydia pomonella*, the codling moth. The third brood usually remains through the winter in the pupal stage. Spraying with lead arsenate is effective if carried out from the sixth to eighth day of flowering; after this time, the calyx closes and spraying is useless. Young trees are frequently attacked by the red mite, which hatches from eggs laid in clusters at the junction of the branches with the stem, or in any broken part of the bark; lime-sulphur is the best spray. *Eriosoma lanigerum* (woolly

aphis) is troublesome in old orchards. It is best to plant only trees grafted on Northern Spy or Majetin stocks, since these are immune to attack. Spraying with red oil emulsion in the winter or tobacco wash in the summer, is effective, but the spray must be applied at high pressure. Mussel scale (*Lepidosaphes*) causes serious damage. Spraying with red oil emulsion in winter and lime-sulphur in summer has proved satisfactory. The bark should be scraped before spraying, as the scales collect under loose pieces of it.

JARVIS (E.). **Monthly Report of Acting Entomologist to Bureau of Sugar Experiment Stations.** *Queensland Agric. Jl., Brisbane*, iii, no. 3, March 1915, pp. 115–117.

Definite results have been obtained conclusively proving that *Lepidiota albohirta* (the grey-backed cane-beetle) is strongly attracted by white light. On three successive evenings, beginning 14th December, a total of 170 beetles were caught, 131 being males. An acetylene burner of 28 litres capacity, in a specially designed beetle-trap, was placed facing the centre of the field with the object of attracting beetles that might be emerging among the cane. Recent experimental work with the Samoan fungus, *Metarrhizium anisopliae*, has resulted in a 50 per cent. infection of grubs of *Lepidiota rothei* (the cane-beetle) after twenty-eight days, the first larva being killed nine days after infection and others succumbing a fortnight later. Adults of four additional species of Lepidoptera, not hitherto recorded on sugar-cane, have been reared from larvae. Three of these are Hesperids, while the fourth is a moth-borer, not yet identified, which was observed tunnelling the centre of young shoots of ratoon cane, occasioning injury identical with that caused by the Noctuid, *Phragmatiphila truncata*, Wlk.

NICHOLLS (H. M.). **The Saw-Toothed Grain Beetle, *Silvanus surinamensis*, Linn.** *Agric. Gaz. Tasmania, Hobart*, xxiii, no. 3, March 1915, pp. 87–90, 2 figs.

Silvanus surinamensis, the saw-toothed grain beetle, lives upon stored food-stuffs. A suitable poison-bait can be made up of arsenic 1 part, sugar 2 parts, flour 6 parts and water. In barns which are sufficiently air-tight, fumigation should be carried out as soon as the beetles appear; if potassium cyanide and sulphuric acid are used, fumigation should be continued for 24 hours. Carbon bisulphide can be used on materials intended for human consumption, 10 lb. being required for 1,000 cubic feet. The beetles are very sensitive to extremes of temperature; in America, a temperature of 125° F. is applied by means of steam-pipes for the destruction of the insects in flour-mills. Kerosene emulsion, consisting of 1 gal. kerosene, 1½ lb. soft soap, and 10 gals. water, or crude carbolic acid, are valuable spraying solutions for stables, etc.

Ward (J. M.). **Cultivation of the Plum.**—*Agric. Gaz. Tasmania, Hobart,* xxiii, no. 3, March 1915, pp. 91–95.

The most important insect pest of the plum in Tasmania is *Eriocampoides limacina* (*Selandria cerasi*), the pear slug. It can be well controlled by spraying the foliage early in January with lead arsenate, 5 lb. to 100 gals. water. Plums are also sometimes attacked by the San José scale, *Aspidiotus perniciosus.*

The East Africa Protectorate Coconut Preservation Ordinance, 1915. [Received from the Colonial Office, 24th April 1915.]

In this ordinance, provision is made for the inspection of any land upon which coconut is grown. The owner of any tree which is dead or dying or is attacked by insects, is required to remove and destroy it, or to deal with it according to the direction of the inspector. A fine not exceeding Rs. 75 shall be imposed on any person who neglects to carry out the inspector's instructions. Accumulations of vegetable refuse, including dying trees, coconut timber, etc., which would be likely to harbour insects, must be destroyed ; a fine, not exceeding Rs. 150 can be imposed on any person who neglects or refuses to remove such waste material. The Governor may make such compensation as he thinks fit to any owner who is required to destroy a coconut tree. The Governor in Council may make rules (1) for regulating the importation of seed coconuts or coconuts in husk or shell; (2) for regulating the procedure to be adopted with regard to insect pests, and (3) for the construction on coconut plantations of traps for insects.

Dupont (P. R.). **Insect Notes of Curator, Botanic Station, Seychelles, 18th March 1915.** [MS. received from Colonial Office, 23rd April 1915.]

The small black ant, *Technomyrmex albipes*, and scale-insects, the principal injurious insects of the archipelago, have been destroyed in large numbers by the recent rain. The hilly nature of the country renders poisonous solutions of little use against *T. albipes.* Pending the discovery of a harmless natural parasite, the best method is the use of trap boxes, in addition to the systematic destruction of the nests by spraying with soda resin solutions. Certain varieties of banana are subject to the attack of *Sphenophorus striatus*, the banana borer, while other species are immune. The suckers of infested varieties are usually damaged to such an extent that replanting each year is necessary. A beetle which preys on the borer is known in Java and has already been introduced into Fiji. A consignment of Gros Michel banana suckers imported from Fiji were infested by *Cosmopolites* (*Sphenophorus*) *sordidus.* The same variety is also subject to a fungus which may possibly predispose the plant to an attack by weevils.

Report on the Agricultural Department, St. Vincent, for the year ended 31st March 1914.—*Barbados*, 1914.

Experiments were carried out during 1914 to determine whether starch and arrowroot were subject to the attacks of grain beetles

(*Calandra oryzae* and *Tribolium confusum*) and a Dermestid. The results indicated that the beetle larvae could exist and reach the adult stage in arrowroot starch, but appeared unable to breed in it. There thus seems little possibility of weevils proving destructive to arrowroot. The attacks of *Colaspis fastidiosa*, the small bronze beetle, now seem to be limited in area and duration. A dusting of lime on infected fields appeared to do some good. *Alabama argillacea*, the cotton worm, was successfully controlled. *Saissetia nigra* was a serious cotton pest only where such wild trees as almond, sugar apple and *Hibiscus*, which were subject to its attacks, grew near the cotton fields. *Hemichionaspis minor* has been partially controlled by cutting the cotton trees as low as possible. *Calpodes ethlius*, the arrowroot worm, was greatly reduced in numbers by a Tachinid parasite. The Dynastid beetle, *Cyclocephala vincentiae*, has been found boring into the rhizomes of arrowroot, resulting in the production of dirty and inferior starch; the adults are attracted to lights in the field. A field of cassava was badly attacked by mealy-bug. Thrips were again in evidence, but not in sufficient numbers to require any control measure. Two new species of thrips have been identified, viz., *Corynothrips stenoptera* and *Frankliniella melanommata*. The Pentatomid, *Edessa meditabunda*, was found on some estates and was dealt with by hand-picking. *Eudamus proteus*, the bean leaf-roller, was abundant.

EHRHORN (E. M.). **Report of the Division of Entomology for the Biennial Period ending December 31st, 1914.**—*Hawaii Bd. Agric. & Forestry, Honolulu.* 1915, pp. 103–161, plates 15–18.

During 1913 and 1914, the inspection of imported vegetable products has been continued. Shipments of rice and beans have been watched for *Calandra oryzae*, and the Pyralid, *Paralipsa modesta*. Improvements have been made in the fumigating station. A list of the pests intercepted by the inspectors is given. *Adoretus tenuimaculatus*, the Japanese rose beetle, has been very abundant in the early summer of 1914, owing to severe dry weather; normally it is kept in check by a fungus. Coconut plantations in Oahu and Kauai have suffered from the attacks of *Omoides blackburni*, the leaf-roller. The pest is usually kept in check by parasites of the eggs, larvae and pupae, but weather conditions have been unfavourable for the increase in the number of parasites. Alligator pear trees have been attacked by *Xyleborus immaturus*. The beetle deposits its eggs on the bark and the larvae burrow into the wood. The presence of the pest can be detected by a white powdery substance on the limbs and trunk of the tree. Affected spots should be cut out and a coating made of lime and crude oil applied. *Eleutherodia dytiscoides*, the tree cockroach, has been found on cypress hedges and trees and on Thuya plants, damaging the smaller branches by gnawing off the bark. Single trees can be protected by dislodging the insects and killing those that fail to the ground. Several species of cutworms have caused damage to crops. Poison bait, consisting of 1 lb. Paris green or white arsenic, $\frac{1}{2}$ gal. molasses, 20 lb. bran and water, placed close beside the plants, is a satisfactory remedy. Three species of mealy-bugs injure outdoor plants and trees. *Pseudococcus nipae* attacks young figs and palms and should be sprayed as soon as detected with strong soap and water

spray, consisting of 1 lb. whale oil soap to 3 gals. water; the spray should be applied warm. *P. filamentosus*, the fluffy mealy-bug, has a tendency to poison the young shoots of hibiscus, citrus, etc. The pineapple mealy-bug [*P. bromeliae* (?)] infests the pineapple, as well as the roots of many flowering plants and bulbs. The spray given above is also suitable for these two species. Whale-oil soap has also been used in the control of *Chrysomphalus aonidum*, the Florida red scale, and *Lepidosaphes beckii*, the purple scale, both attacking citrus trees and palms. *Aphis gossypii*, the cotton aphis, was found during 1913 and 1914 attacking water-melon plants; spraying, while the plants are still young, will generally enable them to withstand the later broods. *Myzus citricidus*, the orange aphis, is liable to check the growth of young trees; spraying with soap solution is useful, while this species is also kept in check by predaceous insects. Three species of ants, *Pheidole megacephala*, *Monomorium floricola* and *M. pharaonis*, frequently injure stored food. The latter can be protected by the use of dishes containing water into which the legs of tables, etc., are placed, or by tying bands soaked with ant poison around the legs of tables. A more satisfactory method is to endeavour to kill the colony, after finding the nest by trapping with sweetened water. Nests outside buildings can be killed with gasolene or carbon bisulphide. Termites have proved very destructive on the island.

In the report of the work of the insectary, a brief account is given of the success of Prof. Silvestri in obtaining larval and pupal parasites of the fruit fly from West Africa. These parasites were liberated in various localities. The following parasites of the dung fly have been liberated:—The Chalcid, *Muscidifurax vorax*, *Pteromalus* sp. and *Spalangia* sp. A second expedition to West Africa was dispatched in 1914; as a result the following species were obtained:—*Tetrastichus giffardi*, *Diachasma fullawayi*, *Opius* sp. and *Spalangia* sp. Of these, the first two were successfully bred and liberated. *D. tryoni* has also been liberated. A great reduction of flies by the parasites has already been observed.

Back (E. A.) & Pemberton (C. E.). **Parasitism among the Larvae of the Mediterranean Fruit-Fly** (*C. capitata*) **in Hawaii during 1914.** —*Hawaii Bd. Agric. & Forestry, Div. Entom., Honolulu*, 1915, pp. 153–161, 5 tables.

Active interest in the rearing of parasites of the fruit fly began during July 1914, when the authors discovered a parasitism ranging from 29–53·8 per cent. among some pupae derived from *Psidium cattleyanum*, the strawberry guava. It has been found that the South African parasite, *Opius humilis*, is possibly entirely responsible for the noticeable decrease in fruit fly in certain localities. The data on this species will play an important part in determining the increase in its efficiency during coming years. *O. humilis* and *Diachasma tryoni* parasitise only the well grown larvae of the fruit fly. This fact was not at first fully appreciated by the authors, hence the tables given do not do complete justice to the parasites. Parasites have been bred from the larvae developing in *Callophyllum inophyllum*, *Citrus japonica*, *Coffea arabica*, etc., the percentage of parasites being given in each case.

Ehrhorn (E. M.). **Report of the Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu*, xii, no. 3, March 1915, pp. 68–70.

During the month of January 1915, a package of juniper seeds from Japan was found to contain larvae of a Tortricid moth. Soil imported from Japan contained 21 grubs of a small weevil, stated to be a serious pest in that country. Christmas evergreens were found to be infested by *Phenacaspis eugeniae*. The breeding of various parasites of the fruit fly and the horn fly has been continued; the following species have been propagated: *Diachasma fullawayi*, *D. tryoni*, *Tetrastichus giffardi* and *Spalangia* sp.; of these, the first and third have been liberated.

Crosby (C. R.) & Leonard (M. D.) **Insects injurious to the Fruit of the Apple.**—*Cornell Reading Courses, New York State Coll. Agric. at Cornell Univ., Ithaca, N.Y.*, iv, no. 84, 15th March 1915, pp. 121–144, figs. 93–125.

Cydia pomonella, L., the codling moth, causes severe injury to the apple orchards in New York State. Owing to its great economic importance, full details of the life-history have been worked out. The insect has adapted itself to variations in climate by modifying the length and number of generations annually produced. In New York the full-grown larva passes the winter in a cocoon beneath the bark or in crevices of the trees. In early spring, pupation occurs in the same or a new cocoon nearer the surface. The adult emerges in about four weeks. Egg-laying begins in 3–5 days after emerging, the eggs usually being deposited on the leaves, and continues until about three weeks after the blossoms fall. The larvae feed at first on the leaves, then pass to the young fruit, where they feed within the calyx. After remaining within the fruit for about four weeks, during which time the seeds are eaten and a large cavity is hollowed out, the larva burrows to the surface and spins a cocoon in a suitable position. Some of the larvae hibernate thus, others develop and finally produce a second generation. The moths of the second brood emerge in August and lay eggs on the fruit; the larvae remain in the fruit from 5–6 weeks. In the control of this pest, an arsenical poison is sprayed into the calyx cup when the petals are falling. Lead arsenate, in the proportion of 2–3 lb. to 100 gals. water, applied at a pressure of from 100–200 lb. per square inch, has given satisfactory results. The spray should be repeated after about three weeks and again early in August to control the second brood. Lime-sulphur added to the solution acts as a fungicide.

Rhagoletis pomonella attacks summer and early autumn varieties of apples. The adults appear in July and feed on the fruit for some time before egg-laying begins. Eggs are deposited beneath the skin of the fruit. The larvae, which hatch in from 2–6 days, tunnel beneath the skin, where they remain until full-grown. When mature, the larva leaves the fruit and enters the ground to pupate. Winter is passed in the pupal stage, the adult emerging the following year. A small second brood is usually produced, but does little damage. Spraying with sweetened lead arsenate solution is effective in controlling this species.

Heterocordylus malinus and *Lygidea mendax*, the apple redbugs, pass the winter in the egg stage in a slit in the bark at the base of the fruit spurs and around the buds. The eggs hatch after the fruit buds burst. After passing through several nymphal stages, maturity is reached in about four weeks after hatching. The young nymphs feed on the leaves, the older ones puncture the fruit to suck the juice. As a result, the apples frequently fall or shrivel. Spraying with "Black Leaf 40" in the proportion of 1 pt. in 100 gals. water, with 4 or 5 lb. soap in addition, effectually controls the insect. Application should be made as soon as the blossoms begin to open. If the false redbug is present as well, spraying should be repeated after the blossoms fall to kill the young of this species. Lime-sulphur may be mixed with the solution.

Archips argyrospila, the fruit-tree leaf-roller, has recently become a serious pest in New York. This species is not confined to apple, but has been recorded on cherry, plum, quince, rose, currant, etc., and the wide range of food renders conditions favourable for its rapid increase. Winter is passed in the egg stage on the smaller twigs The eggs hatch while the buds are bursting; the young larvae feed on the expanding leaves which they spin together. Later, the larvae attack the fruit, boring large holes into it and in many cases causing the apples to drop. Pupation occurs about three weeks after hatching, taking place within a rolled leaf, from which adults emerge in about 10 days. In cases of moderate infestation, a reasonable degree of control can be obtained by thorough spraying with lead arsenate, 3 lb. in 100 gals. water. In severe cases, the trees should be sprayed before the buds open with a miscible oil, 1 gal. in 15 gals. water. This must be followed by an arsenate spray just after the buds have opened. Lime-sulphur has no effect on the eggs.

Xylina antennata primarily attacks the foliage of poplar, maple and wild cherry, but is sometimes found on the apple. When present in great numbers, it is capable of doing severe damage. Eggs deposited by the moth in March or April hatch just as the buds are bursting. The larvae feed at first on the young leaves, then migrate to the fruit. Pupation occurs at the beginning of June, the larvae burrowing into the soil. In some cases the pupae remain until the following spring, in others the moth emerges and hibernates. Newly hatched larvae are easily poisoned by one or two applications of lead arsenate, 5 or 6 lb. in 100 gals. water, before the flowers open. The second spray may be used in combination with lime-sulphur.

Crosby (C. R.) & Mix (A. J.). **The Control of Apple Insects in Clinton County.**—*Cornell Univ. Agric. Expt. Sta., Ithaca, N.Y.*, Bull. 356, March 1915, pp. 115–130, figs. 36–59.

Conotrachelus nenuphar, the plum curculio, scars the fruit by feeding and egg-laying punctures. The insects hibernate in hedges or stone walls and the first step in control is the elimination of such shelters. Under favourable conditions, where trees are properly pruned, this pest can be controlled by the regular spraying employed for *Cydia pomonella*. *Eucosma* (*Tmetocera*) *ocellana*, the bud moth, hibernates in the immature larval stage. When the buds are bursting, the larvae burrow into them and feed on the young leaves. Pupation takes place in the nest; adults emerge in June, and deposit egg-clusters

on the leaves. The larvae, hatching in about 10 days, feed for some time on the leaves and fruit, then proceed to hibernate in cocoons on the branches. Thorough spraying with lead arsenate, 6 lb. to 100 gals. water or dilute lime-sulphur, when the blossoms show pink, is advised. *Malacosoma americana*, the apple-tree tent caterpillar, feeds on apple, wild cherry, beech, etc. Winter is passed in the egg stage. The larvae live in colonies, and when abundant, defoliate the trees. Pupation takes place in early June; adults emerge in three weeks and lay eggs in July. There is one generation annually. Early spraying with lime-sulphur, followed by a later spray with lead arsenate, is very effective. When pruning the trees, all twigs bearing egg-masses should be burnt. *M. disstria*, the forest tent-caterpillar, attacks maple, apple, plum, cherry and pear. It differs from the preceding species in that cocoons are found in curled leaves. The same control methods can be used. *Lepidosaphes ulmi*, the oyster scale, is most injurious to young trees. It may be controlled by spraying with lime-sulphur, 1 part to 8 of water, when the leaves begin to appear. Applications should be repeated every year. Three species of Aphids are injurious to the apple. *Aphis* (*Siphocoryne*) *avenae*, the apple-bud aphis, appears on the opening buds; the second generation is winged and migrates to various grasses. *Aphis pomi* breeds on the apple throughout the year and causes the leaves to curl and the growth of tree and fruit to be stunted. Young trees are often killed by this species. *A. sorbi*, the rosy apple aphis, develops three generations on the apple, while the remainder of the season is passed on the plantain. The injury inflicted is similar to that of *A. pomi*. Aphids can be controlled by thorough spraying with "Black Leaf 40," ¾ pt. in 100 gals. water, or dilute lime-sulphur solution, the application being made when the lice are clustered on the opening buds. In the case of a small tree, it is better to dip the infested branches into the solution. *Eriosoma* (*Schizoneura*) *lanigerum*, the woolly aphis, is most injurious when found in cankers and wounds, where it feeds on the callus; such wounds should be cleaned out and painted with gas tar. *Melanoplus femur-rubrum*, which during the past two seasons has been very destructive in a few localities, can be controlled by a poison bait consisting of bran, 20 lb.; Paris green, 1 lb.; syrup, 2 quarts; 3 oranges or lemons; water, 3½ gals. This bait should be spread thinly in the early morning, when the grasshoppers are active. A spraying schedule for the various pests is given.

HEINRICH (C.) & GRYSE (J. J. DE). **On *Acrocercops strigifinitella*, Clemens.**—*Proc. Entom. Soc. Washington, Washington, D.C.*, xvii, no. 1, March 1915, pp. 6–14, 8 plates.

An account of the life-history of *Acrocercops strigifinitella*, Clemens, is given. Though common, it is considered unlikely that this moth will become of much economic importance; it chiefly attacks chestnut leaves, injuring them by mining. Since its attacks are restricted to the newer leaves at the ends of the branches and its food supply is scarce during autumn, it is prevented from becoming abundant for more than a short time in mid-summer. It also has many natural enemies and hymenopterous parasites of the larvae have been reared, including: *Sympiesis flavipes*, Ashm., *Pseudopanteles nigripes*, Roh., and *Arthrolytus* sp. A species of *Chrysopa* was twice observed attacking

this insect in its mine, while after leaving the mines, numbers are killed by spiders and birds. There are many generations with considerable overlapping, so that larvae may be found any time from May to October, the dominant period being reached during July and August. The life-cycle is completed in a little over a month in the summer.

WEBSTER (F. M.). **The Hessian Fly.**—*U. S. Dept. Agric , Washington, D.C.*, Farmers' Bull. no 640, 17th March 1915, 20 pp., 17 figs.

Mayetiola destructor, the Hessian fly, causes serious damage to the wheat crop in the United States. Probably two generations occur during favourable seasons; in the south heset are widely separated, while in the north, in regions of spring wheat-growing, they follow each other in quick succession. In autumn wheat-growing sections, the winter is passed in the larval or pupal stage in the young wheat just above the roots. Adults, emerging in spring, deposit eggs on the wheat and the young from these pupate before harvest, passing the summer in the stubble. Adults from the over-wintering larvae hatch later, giving rise to a so-called supplementary second generation. Eggs are deposited on the younger plants; the larvae which emerge may develop into pupae which pass the winter as such, or may produce adults which give rise to another generation. In the north, egg-laying begins in May and the second generation quickly follows the first. In America, the insect is distributed over the eastern and central States and California; it has also been recorded from north Africa, Europe, Western Asia, New Zealand, and parts of Canada. The chief food-plant is wheat, then barley and lastly rye; it also appears to breed freely on *Agropyron smithii* and *A. repens*. An infested wheat plant is without stem, the leaves are short and of a deep bluish-green colour, changing later to yellow or brown. In summer, the effect of the fly is to cause the straw to break before harvest. Most varieties of wheat are attacked when young, but the second brood does not seriously injure more matured plants with strong, stiff straw. Durum wheats do not seem to attract the fly, at least, not the second brood. Weather conditions seem to have an important influence on the fly. Heat and drought tend to keep the insect in the pupal stage. Lack of moisture seems to be very important in influencing distribution and development of the full generation. Among the natural enemies are the Proctotrupids, *Platygaster herricki* and *Polygnotus hiemalis*, and the Chalcids, *Eupelmus allyni*, *Merisus destructor*, and *Boeotomus subapterus*. All remedial measures must aim at (1) the elimination of the pest in the young wheat in autumn, and (2) increase of the vigour of the young plants to counteract the injury. In northern Michigan, wheat may be sown without danger from the fly in early September; in southern Ohio, after the first week in October. A corresponding delay should be followed to the southward. Crop rotation compels the fly to travel a greater or less distance to reach wheat plants. Burning the stubble will destroy the fly and any other insects present. Growth of the self-sown wheat menaces the crop of the following year. The destruction by ploughing must take place before the larvae have matured. The use of good seed and a thoroughly prepared, fertile soil will enable infested plants to retain sufficient vitality to withstand the winter.

NOTICES.

The Editor will be glad to receive prompt information as to the appearance of new pests, or of known pests in districts which have hitherto been free from them, and will welcome any suggestion the adoption of which would increase the usefulness of the Review.

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Bureau, are requested to communicate with the Assistant Editor, 27, Elvaston Place, Queen's Gate, London, S.W.

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THE REVIEW OF APPLIED ENTOMOLOGY.

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QUAINTANCE (A. L.). **The San José Scale and its Control.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 650, 30th March 1915, 27 pp., 17 figs., 2 tables.

The San José scale, *Aspidiotus perniciosus*, infests all deciduous fruit trees, as well as many ornamental and shade trees. On peach, the scales usually attack the older branches; on apple and pear, the terminal twigs are infested, many of the young finding their way to the fruit. Once established in a locality, its spread is accomplished by birds, wind or insects. Numerous natural enemies serve to control the scale. Among predaceous insects the Coccinelids, *Microweisea misella* and *Chilocorus bivulnerus*, are the most important, and the following parasites have been reared: *Aphelinus fuscipennis*, *A. mytilaspidis*, *Aspidiotiphagus citrinus*, *Physcus varicornis*, *Prospaltella* sp., *Rhopoideus citrinus*, etc. A fungus disease, due to *Sphaerostilbe coccophila*, has been investigated; its abundance has been found to depend on weather conditions. The only means of artificial control is by spraying after the removal of dead or weakened wood. Three series of sprays are considered: (1) lime-sulphur wash series; (2) petroleum-oil series (including miscible oils); (3) soap washes. Commercial lime-sulphur, if used at the proper strength, has proved satisfactory in controlling the scale. It has been found possible to prepare lime-sulphur concentrates at home for immediate or later use; 50 U.S. gals. water is brought to the boiling point and to it is added 50 lb. of lime and then 100 lb. sulphur. The mixture is stirred and strained through a 30-mesh strainer. The solution should be stored in air-tight receptacles. The strength of the solution thus prepared should be tested with a hygrometer, to determine the amount of concentrate to use in a given quantity of water. A dilution table of concentrated solutions is given. Spraying should be carried out when the trees are dormant; summer spraying should only be performed if absolutely necessary, and a self-boiled mixture should be used. The latter is made up in the proportions of 8 lb. lime, 8 lb. sulphur to 50 gals. water. The lime is covered with water and sulphur gradually added; sufficient heat is generated to boil the mixture for several minutes; the remainder of the water is added, the solution strained, diluted and applied. Pure kerosene can only be applied to dormant trees; the same holds for pure crude petroleum. Kerosene emulsion, consisting of 2 gals. kerosene, ½ lb. fish-oil soap and 2 gals. water, forms a suitable spray. The emulsion is diluted to 10–20 per cent. before using. Crude petroleum emulsion, prepared as above, should not be used in summer, as it is likely to cause injury to the foliage. Miscible oils, consisting essentially of petroleum oils with the addition of a vegetable oil and an alkali, are very useful for winter spraying. Fish oil soap wash, at the rate of 1 lb. to 1 gal. water, is used on dormant trees; a more dilute solution can be used to spray the foliage. Various kinds of spraying apparatus are described. Severe pruning of infested trees is desirable to simplify the work of treatment.

MIDDLETON (W.). U.S. Bureau Entom. **Notes on some Sawfly Larvae belonging to the Genus** *Dimorphopteryx*.—*Proc. U. S. Nat. Mus., Washington, D.C.*, xlviii, 18th March 1915, pp. 497-501, 4 figs., 1 plate.

Dimorphopteryx castaneae occurs in the early larval stages on the

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leaves of *Castanea dentata*, feeding on the upper epidermis and parenchyma; in later larval stages, holes are eaten through the leaves. The larval period lasts from July to September; the pupae hibernate through the winter, the adults emerging in early June. *D. autumnalis* attacks *Quercus rubra*; the larval period lasts from August to October. The larvae of *D. quercivora* feed on *Q. rubra* and pupate in the ground. *D. errans* attacks birch and linden. A general account of the genus, together with descriptions of the larval stages of each of the above species, is given.

SCOTT (E. W.). **Home-made Lime-Sulphur Concentrate.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 197, 31st March 1915, 6 pp. 4 tables.

During the past few years, experiments have been made in connection with the making of lime-sulphur concentrates, in order to determine the density and percentage of "sludge" which would result from the use of different formulae. The tabulated results show that the concentration varied from 27°–35·5° Bé., being in most cases about 30°, while the percentage of sludge varied from 40–50. The 50–100–50 formula is generally recommended for the preparation of home-boiled concentrated solution. The method is to boil together for 50–60 minutes, 50 lb. lime, 100 lb. sulphur and water to make 50 gals. of the concentrated solution. Fresh, stone lime, containing not less than 90 per cent. of calcium oxide, is necessary. The lime and then the sulphur are added to the boiling water and the mixture is stirred until the lime is slaked, i.e., for about one hour. If the solution is to be stored without filtering, it should be run off through a 30-mesh strainer. A highly concentrated solution can be made according to the formula 80–160–50, the quantity of water being reduced in this case. Solutions thus prepared should test 33°–34° Bé. The cost of the concentrated solution, in large quantities, is about 14s. per barrel of 50 U.S. gals. [41½ Impl.], and that of the weaker about 4s. less.

CUSHMAN (R. A.). U.S. Bureau Entom. **Descriptions of six new Species of Ichneumon Flies.**—*Proc. U.S. Nat. Mus., Washington, D.C.*, xlviii, 18th March 1915, pp. 507–513.

The following Ichneumons are described, *Bassus carpocapsae*, *Aenoplex carpocapsae*, *A. plesiotypus*, *Glyptra brevis*, all from *Cydia pomonella*, and *Notopygus virginiensis* and *Idechthis nigricoxalis*, from *Euzophera semifuneralis*.

COOK (A. J.). **Potato Pointers.**—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, no. 3, March, 1915, pp. 154–157.

The potato tuber moth (*Phthorimaea operculella*), causes serious injury by boring through the tubers and blackening the tissue. In order to control this pest, all tubers for seed should be treated with formalin or corrosive sublimate before planting, and should be planted in a disease-free soil. Growing potatoes should be kept well covered; no tubers should be left in the ground, but, as soon as dry, they should be packed in moth-proof sacs. A long rotation should be practised.

WHITNEY (L. A.). **The small Sweet Potato Weevil.**—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, no. 3, March 1915, pp. 162–164, figs. 24–28.

Euscepes (*Cryptorrhynchus*) *batatae* has been found on tubers imported from Honolulu. It is almost impossible to detect its presence from external conditions, as the larvae enter the tuber while very small and the only evidence of their presence would be a slight exudation of gum which is easily brushed off. The only certain method of determining infestation is examination with a knife. The eggs of the weevil are laid on the surface of the sweet potato and the larvae bore into the interior. The larval and pupal stages are passed within the tuber, which gradually decays.

VOSLER (E. J.). **Calendar of Insect Pests and Plant Diseases.**—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, no. 3, March 1915, pp. 165–169.

The adults of Fuller's rose beetle (*Pantomorus fulleri*) feed on the foliage of citrus trees. Eggs are deposited on the bark, and the larvae feed on the roots, the adults crawling up the trunks to attack the leaves. Bands of cotton batting about 4 inches wide placed round the trunk prevent the ascent of the adult. The *Diabrotica* beetle, also attacking citrus foliage, can be controlled by shaking the tree over a tarred screen, or by spraying with lead arsenate, 5 lb. to 50 gals. water. The larvae of the peach twig borer (*Anarsia lineatella*) emerge in early spring and bore into the new shoots. Spraying with lime-sulphur solution, 1 part in 10 parts water, just as the blossoms begin to open, is very effective. This may be followed by a later spraying with lead arsenate, 4 lb. to 50 gals. water. Against the larvae, the most common remedial measure is to cut out the borer with a sharp knife. The resistant Myrobalan cherry plum can be used as a stock upon which the peach is grafted. Hard asphaltum, applied when warm, 5–6 inches below the surface of the soil, has been found useful. In spraying for the codling moth (*Cydia pomonella*), lead arsenate, at a strength of 5 lb. to 100 gals. water, should be applied when the flower petals are falling. The brown day moth (*Pseudohazis eglanterina*) feeds on the leaves of deciduous fruit trees. The eggs are deposited in clusters round the twigs. The larvae, when full grown, drop to the ground to pupate. There are several broods in the year. The larvae can be destroyed by lead arsenate, 3 lb. to 50 gals. water. The rose aphis (*Macrosiphum rosae*), can be controlled by spraying with soap solution or "Black Leaf 40," 1 to 1,000 parts water. The raspberry horntail (*Hartigia cressoni*) attacks raspberry, blackberry and loganberry. The eggs are inserted in the tips of the shoots; the larvae, as they burrow outwards, kill the terminal part of the cane. The best control measure is to destroy the eggs by pressure before they hatch; the shoots will not be injured by this treatment. Cutworms can be killed by a poison bait, composed of 1 lb. Paris green, 50 lb. bran, molasses and water, made into a stiff paste.

Insect Notes.—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, no. 3, March 1915, p. 170.

The larvae and pupae of *Scutellista cyanea*, the predaceous egg-parasite of the black scale, *Saissetia oleae*, Bern., have been found in

Los Angeles County. Specimens of *Desnia* (?) *funeralis* have been reared from grape cuttings. Cocoons of *Samia ceanothi* were collected from the sweet birch; their scarcity was probably due to heavy parasitism by a Tachinid and a large Chalcid, possibly *Spilochalcis maniae*. *Parlatoria pergandii* has been recorded on *Araucaria bidwillii*; *Aspidiotus hederae*, the common ivy or oleander scale, was collected on *Asparagus sprengeri*. *Aulacaspis manzanita* is very common on manzanita in the Sierra Nevada mountains. Large numbers of *Hippodamia convergens* have been collected from the cañons in the high Sierras of Placer County. Specimens of the mite, *Stigmaeopsis celarius*, have been reported from Pasadena on bamboo.

MASKEW (F.). **Quarantine Division. Report for the month of January 1915.**—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, no. 3, March 1915, pp. 171–172.

The following is a list of pests intercepted:—At San Francisco, from Florida, *Phomopsis citri*, *Lepidosaphes beckii* and *Parlatoria pergandii* on oranges; from Honolulu, *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples, *Coccus longulus* on betel leaves, *Euscepes* (*Cryptorrhynchus*) *batatae* in sweet potatoes; from Japan, weevil larvae in sweet potatoes and chestnuts, Noctuid and Tipulid larvae in *Zysia pangens*, *Leucaspis bambusae* on bamboo, *Phomopsis citri* on pomelos; from Lamas experiment station, *Lepidosaphes gloveri* and *Coccus* sp. on citrus cuttings; from Manila, *Ceroplastes ceriferus* and *Ceroplastes floridensis* on *Camellia*; from Nevada, *Heterodera radicicola* in potatoes; from New York, *Pseudococcus pseudonipae*, *Eucalymnatus perforatus*, *Chrysomphalus aonidum* (*ficus*) and *Cerataphis lataniae* on *Kentia* palms, *Chrysomphalus aonidum* (*ficus*) on *Ficus* sp.; from New Zealand, *Saissetia oleae* on an unidentified plant; from Papute, *Parlatoria pergandii* and *Lepidosaphes beckii* on limes.

At Los Angeles Station: from Florida, *Lepidosaphes beckii* and *Phomopsis citri* on grapefruit; from Japan, *Chrysomphalus aonidum* (*ficus*) and *Hemichionaspis aspidistrae* on *Aspidistra lurida*; from Missouri, *Aphis persicae-niger* on peach trees; from Oregeon, *Cydia pomonella* on apples.

At San Diego Station: from Iowa, crown gall on deciduous stock; from Mexico, *Lepidosaphes* sp. and *Chrysomphalus* sp. on lemons.

SURFACE (H. A.). **Some Pennsylvania Birds and their Economic Value.**—*Bi-monthly Zool. Bull. Pennsylvania Dept. Agric., Harrisburg, Pa.*, iv., nos. 1 and 2, January-March 1914, 46 pp., 4 plates. [Received 18th May 1915.]

An account is given of birds of the families TANAGRIDAE, HIRUNDINIDAE, AMPELIDAE, LANIIDAE, VIREONIDAE and MNIOTILTIDAE, some of which are almost exclusively insectivorous and consequently of considerable economic importance. The food of the wood warblers, for example, includes bark beetles, boring beetles, moth larvae, aphids and insect eggs. *Dendroica pennsylvanica*, the chestnut-sided warbler, consumes great numbers of injurious bugs, plant lice, ants and beetles found on bark and foliage.

SURFACE (H. A.). **The Importance of Inspecting Imported Trees.**—*Zool. Press. Bull., Pennsylvania Dept. Agric., Harrisburg, Pa.*, no. 309, 29th March 1915.

The pine shoot moth has been discovered on a number of imported pine trees. This insect is well known in Europe as a dangerous pest. It attacks the terminal buds, resulting in a deformed growth. Injury is mainly confined to young trees. The moth is so liable to be introduced into America, that the Horticultural Board has issued orders prohibiting the importation of young pines from Europe after 1st July, 1915. Numerous other pests have been discovered on imported plants.

FORBES (S. A.). **The Ecological Foundations of Applied Entomology.**—*Ann. Entom. Soc. America, Columbus*, viii, no. 1, March 1915, pp. 1–19.

Successful ecological inquiry in the economic field may often suggest and illustrate methods useful in entomology, and therefore is of interest to every entomological specialist. There is no real separation between economic and non-economic entomology. The most essential phase in the expansion and development of the subject is the application of the results of investigation. The field of applied entomology is that part of ecology in general over which the ecology of man and that of insects is coincident. An analysis of our knowledge of one of the great insect pests gives a clear idea of what is involved in economic entomology and what are the foundations upon which it rests. For example, the chinch-bug (*Blissus leucopterus*), of the western grain fields, has been an object of study for many years. Facts are known concerning its distribution, food supply, parasites, and life-history, as well as the value of certain insecticides in controlling it. It is known that all measures against this insect are of little avail, if undertaken sporadically ; for their full effect, they must be made use of by whole communities. No better illustration of the economic value of ecology can be offered than by the insect-borne disease, malaria, the study of which has been brought to the point of a scientific and practical success, perhaps the most remarkable of any achievement of applied entomology. Association ecology is another division which up to now has received little attention. Even when treating in a comprehensive way of all the insects infesting a single crop plant, little attention is paid to the ways in which the different insect members interact with each other, unless they are parasitic or predaceous. Ecological succession has also points of contact with economic entomology.

BAKER (A. C.). **The Woolly Apple Aphis.**—*U.S. Dept. Agric., Washington, D.C.*, Rept. no. 101, 31st March 1915, 56 pp., 3 figs., 15 plates.

Eriosoma lanigerum, the woolly apple-aphis, is one of the most troublesome and widely distributed apple pests. As a result of experiments, the author concludes that this species was originally an elm-*Crataegus* feeder, which later adopted the apple. The eggs are usually laid upon the bark of elms. The stem-mother, hatching out

at the beginning of April, migrates to the base of a bud. When the latter opens, the leaves curl about the insect, and in the shelter so formed, young are produced. This second generation is wingless, lives within the curled leaves or on the young twigs, and matures in early May. A third generation is produced, present upon elm leaves from May to June; this form is winged and migrates to apple or related plants. It gives rise to a fourth wingless generation, which is the best known form. Of the fifth generation, which is similar to the fourth, some individuals migrate to the roots, others remain on the twigs. The latter give rise to a sixth generation of winged forms about the middle of September. This generation migrates to the elms, upon which sexual forms are produced. The female, after pairing, deposits her solitary egg in a crevice of the bark, where it passes the winter, to hatch as a stem-mother in the following spring. A full account of the anatomy of the various forms is also given.

Nakayama (S.). **Notes on the Life-History and Habits of the Rose Scale,** ***Aulacaspis rosae*****, Bouché.**—*Jl. Entom. & Zool., Claremont, Cal.*, vii, no. 1, March 1915, pp. 45–51, 2 plates.

The rose scale is a common pest of blackberries, raspberries and roses. The various stages in the life-history are described. Females, which became adult in December 1912, began egg-laying in early January 1913. The larval period lasted a month; adults, developing from the larvae, oviposited in April. The second generation of adults reached maturity in June, many young females being destroyed by a Hymenopterous parasite. Egg-laying by the females of the second generation took place in July and the adults of the third generation were observed in September. The fourth and last generation lasted from October to late in December. The following enemies were abundant in 1913:—the Coccinellid beetles, *Chilocorus bivulnerus* and *Scymnus marginicollis*, and a Hymenopterous parasite as yet undetermined.

Sanders (J. G.). **Control of the Onion Fly, a new Discovery that saves the Crop.**—*The Country Gentleman, Philadelphia, Pa.*, 20th March 1915, pp. 40–41, 2 figs. [Received 14th June 1915.]

The life-history of *Hylemyia antiqua*, the onion fly, is described. The life-cycle occupies about 26 days, and two or three broods appear during the season. The first brood causes the greatest damage on account of the small size of the onion plants, and the small amount of food available involves the migration of the larvae from plant to plant. Among the older control methods are the use of carbolic soap emulsion, sand soaked with kerosene or whitewash scattered between the rows, and coal-tar products. Experiments were carried out to test the effect of poisoned bait on the adult before the time of egg-laying. A spray consisting of one-fifth of an ounce of sodium arsenate in 1 gal. of water, to which has been added 1 pint of molasses, proved very effective. The spray should be applied in large drops; alternate strips of the field can be left, since the flies are strongly attracted by the spray when freshly applied. It is advisable to apply the spray at least twice a week during rainy weather.

Gahan (A. B.). Notes on two Parasitic Diptera.—*Proc. Entom. Soc. Washington, Washington, D.C.*, xvii, no. 1, March 1915, p. 24.

Three adults of *Sarcophaga* (*Helicobia*) *helicis* are stated to have been reared from *Stagmomantis carolina*, but it is suggested that these Diptera gained entrance through the mouth of the Mantid, while it was eating the parent fly, and are not truly parasitic. Two adults of the Tachinid, *Metachaeta helymus*, Wlk., were reared from *Cirphis* (*Leucania*) *unipuncta*, this being the first record of a host for this species.

Woodworth (C. W.). The Toxicity of Insecticides.—*Science, Philadelphia*, xli, nos. 105–3, 5th March 1915, pp. 367–369, 1 table.

A series of determinations were made on the effect of hydrocyanic-acid gas on the eggs of scale-insects. Nearly 300 series were studied, including five different species of scale-insects, from 11 localities in California. The experiments show that long continued action of hydrocyanic-acid gas, used at a strength below that producing fatal results, exerts a stimulating influence. Fatal results generally followed from weak doses when the exposure was long, but the experimental results did not agree with the assumption that the toxicity was dependent on the amount of gas absorbed, assuming that this amount varied directly as the time and density.

Patch (Edith M.). Maine Aphids of the Rose Family.—*Maine Agric. Expt. Sta., Orono*, Bull. no. 233, November 1914, pp. 253–280, figs. 89–97. [Received 5th June 1915.]

This paper deals with aphids of members of the rose family other than those of the apple. *Prociphilus corrugatans* occurs on *Crataegus* and *Amelanchier*, inhabiting the ventral surface of the leaf, which becomes curled by its attacks. The spring migrants from the primary host take flight from the middle of June to early in July. The summer host is unknown. The first generation becomes mature early in June; stem females begin to reproduce about the 5th June. *Macrosiphum crataegi* is found on the petioles and young shoots of *Crataegus*. *Aphis avenae*, the oat aphis, has for its hosts the oat and *Crataegus*. *A. brevis* is abundant on hawthorn; it migrates for the summer to clover and sweet peas. *Myzus porosus* has been taken from wild strawberry. *M. cerasi* is a common pest on wild and cultivated cherries, congregating on growing shoots and on the lower surface of the leaves. *Aphis furcata* has been found on *Prunus virginiana*; *A. cerasifoliae* occurs on the same species, on the lower surface of the terminal leaves. *A. tuberculata*, the red and black aphis of cherry, collects in dense red masses on the new shoots of *Prunus serotina*. *A. prunorum*, *A. cardui* and *Hyalopterus arundinis* have been found on cultivated plums. *Phorodon humuli* is a serious pest of the hop and plum in some parts of Maine. *Eriosoma* (*Schizoneura*) *lanigerum* is common on *Pyrus americana* and *P. sitchensis*; it migrates, in Maine, to the mountain ash in June, the return migration taking place in the autumn. *E. lanigerum*, *A. avenae*, *A. pomi*, *A. sorbi*, and *Myzus persicae* all have the apple as one host. *Macrosiphum rosae*, *M. solanifolii*, *M. dirhodum*

and *Myzus rosarum* occur on *Rosa* sp. *Aphis rubiphila* and *Macrosiphum rubicola* have been collected from wild raspberry. *A. spiraecola*, *A. spiraephila*, and *Myzus spiraecola* are found on *Spiraea* sp.

WORSHAM (E. L.). **Regulations concerning the Mexican Cotton Boll Weevil.**—*Georgia State Bd. Entom., Atlanta*, Circ. no. 14, 15th July 1914, 6 pp., 2 plates, 1 map. [Received 6th July 1915.]

The following regulations, adopted in June 1914, attempt to restrain the spread of the boll-weevil, *Anthonomus grandis*. The quarantine line in Georgia has been established 50 miles east of the line established by the State of Alabama and the U.S. Dept. Agric. at the end of 1913. The shipment into Georgia of cotton seed, seed cotton, hulls and cotton pickers' sacks from infested territory or from any point situated within 20 miles of infested territory is prohibited. Spanish moss is not allowed to enter or pass through uninfested parts of the State, except during the months of July, August and September. Specimens of cotton which are believed to contain any stages of the weevil must be sent to the State Entomologist for examination and must be enclosed in tightly wrapped, sealed packages. These rules apply to the entire State of Georgia and to any other State as soon as the weevil has been reported to be present.

WORSHAM (E. L.). **The Mexican Cotton Boll Weevil.**—*Georgia State Bd. Entom., Atlanta*, Bull. no. 39, February 1914, 24 pp., 1 fig., 7 plates. [Received 6th July 1915.]

Anthonomus grandis, the cotton boll weevil, reached, in the autumn of 1913, a point about 6 miles from Georgia. The average rate of extension of the pest is about 65 miles a year, and it is estimated that, in 1916 or 1917, the weevil will become generally destructive in the State. In Texas, in 1901, the loss from this weevil in 32 infested counties was 100,920 bales ; in 1904, it had increased to 550,000 bales. The weevil is restricted to the cotton plant, and passes the winter in the adult stage, old cotton stalks, dead leaves, timber, etc., affording shelter. A temperature below 12° F. is fatal to hibernating individuals. The date of emergence varies from February to July. The first weevils to emerge feed upon young seedlings, puncturing the stem at or just below the attachment of the cotyledons. One of the first effects of oviposition is the opening of the bracts and the exposure of the bud. The larva hatches in about 4 days and feeds first on the immature pollen in the centre of the square, then on the pistil and other tissues of the bud. Many eggs are laid in bolls, and the larvae from these feed on the seeds and occasionally on the immature fibres. During the summer, the average length of the larval stage is 8 days. The pupal period varies from 2–14 days. Ten generations may occur in one season. Adults of any generation may hibernate on the approach of cold weather. During spring and summer, there is a continual flight of weevils from plant to plant. In autumn, large numbers make flights of considerable length to seek new feeding grounds, the yearly increase in distribution taking place at this time. The weevil may be prematurely carried into uninfested territory in cotton seed and cotton seed products, in wagons, railways, or on clothing. Among predaceous

insects, ants and ground beetles are effective enemies. The following Chalcids are the most important parasites: *Eurytoma tylodermatis*, *Microdontomerus anthonomi*, *Habrocytus piercei*, *Catolaccus hunteri*, and *C. incertus*. Numbers of eggs and larvae are killed by the rapid proliferation of the tissues in which the eggs are laid. The only effective methods of control are cultural ones; the destruction of cotton stalks in the autumn, clean cultivation, crop rotation, early planting, fertilising and working, are all important factors. The hand-picking of fallen squares proves a satisfactory means of control in some localities; the squares should be burned or, preferably, placed in wire cages so that the parasites may escape. Early varieties of cotton should be selected; those which do not form a "top crop" in late autumn, which tend to retain infested squares, and which have hairy stems, are the best kinds to plant.

The disease of cotton, known as cotton wilt, which occurs throughout South Georgia, can be controlled by rotation with peas, velvet beans, or grain crops and by growing wilt-resistant varieties.

MOORE (J. G.). **Strawberry Culture in Wisconsin.**—*Agric. Expt. Sta. Univ. Wisconsin, Madison*, Bull. 248, March 1915, 40 pp., 11 figs., 6 tables.

The common pests of the strawberry are the leaf-spot disease, the white grub [*Lachnosterna*] the strawberry leaf-roller [*Ancylis comptana*], the strawberry aphis [*Aphis forbesii*], and the weevil [*Otiorhynchus ovatus*]. The white grub attacks the plant near the crown, severing the top from the roots. No very satisfactory remedy is known. Newly ploughed land should be avoided; shallow ploughing in autumn will help to reduce the number of grubs. The leaf-roller causes injury by rolling the leaves on which it feeds. The first brood appears at fruiting time; poison sprays may be used against the second brood. The strawberry aphis is not easily controlled, since it works beneath the ground. Precautions should be taken against infestation from outside sources. If badly infested, it is best to start a new plantation. Burning over the ground, late in autumn, is useful. The strawberry weevil punctures the flower bud and lays an egg in the interior. There is no satisfactory remedy.

SWENK (M. H.). **The Important Insect Enemies of Field Crops in Nebraska and their Control.** *Bull. State Entomologist, Lincoln, Nebraska*, no. 3, 15th September 1914, 24 pp., 12 figs. [Received 10th July 1915.]

The effectiveness of crop rotation, as a preventive of insect increase, is largely dependent upon the food habits of the pest concerned and to some extent upon the ease of diffusion of the adults. The western corn-root worm [*Diabrotica longicornis*] can be absolutely controlled by crop rotation. The adults lay eggs at the base of the maize in late August and September, the larvae which hatch in the following May and June attacking the roots. If another crop is planted on this field, the larvae which hatch out the next year will find no suitable food plant, and will be absolutely exterminated. Crop rotation affords an important temporary check in the case of *Aphis maidi-radicis*, the corn-root louse. Rotation often causes the destruction of the adults

by enforcing a migration in search of new food-plants. The adults of *Mayetiola destructor*, the Hessian fly, suffer great mortality when forced to migrate through the introduction of an immune crop. Insects having a wide range of food-plants are less affected. A constant supply of wireworms, meadow maggots, click-beetles, cutworms, etc., emanates from unbroken grasslands. A frequent breaking up of such lands in the autumn, previous to changing the crop, will have a beneficial effect in decreasing the numbers of field pests in general. In the case of such forms as white grubs (*Lachnosterna*) and wireworms, it is important that maize should be followed by a different kind of crop, since the insects require 2 or 3 years in the soil to complete their development. The danger to maize from *Sphenophorus parvulus* may be eliminated by ploughing in autumn. The insects will abandon the field either in autumn or in the following spring, in order to find timothy plants upon which to oviposit. Early autumn ploughing is useful to destroy the pupae of wireworms, white grubs and meadow maggots. Later cultivation is effective in the control of grasshoppers, blister-beetles, webworms and *Aphis maidi-radicis*. Special cultivation with the spike-tooth disk-harrow is necessary to break up the egg-masses of grasshoppers in lucerne fields. Clean cultivation will help to eliminate such pests as aphids and cutworms. Modification of the time of sowing constitutes a control measure of great importance. This is especially the case with *Mayetiola destructor*, the fall army-worm (*Laphygma frugiperda*), and the corn-ear worm (*Chloridea obsoleta*). Maize planted on May 1st shows a yield of over 40 per cent. more than that planted a month later, owing to the fact that the silking period avoids the period of flight of the corn-ear moths. The adjustment of the blooming period of certain leguminous crops to protect them from attack by *Bruchophagus funebris* is comparable with the adjustment of the time of seeding with the cereal crops. Burning over grass land in late autumn and early winter is the most effective means of combating the chinch bug, *Blissus leucopterus*. Wheat stubble should be destroyed as soon as possible after harvest either by burning or ploughing; in this way the pupae of the Hessian fly and the wheat straw-worm will be removed. Treatment of maize seed with a mixture of oil of lemon and wood alcohol prevents attack by brown ants and lice; soaking the seeds in Paris green and water and then thoroughly drying is said to repel corn-seed beetles. *Aphis maidi-radicis* can be controlled by adding oil of tansy to any fertiliser in the proportion of ¼ lb. in 1 gal. wood-alcohol to 100 lb. fertiliser. The use of poisoned bran mash has given good results against grasshoppers, cutworms and click-beetles. Barriers, in the form of furrows or lines of coal tar or road oil, prevent the migration of army worms, cutworms and chinch bugs. Feeding pigs in fields infested with white grubs, meadow maggots or cutworms has been found a most effective way of destroying these pests.

OBERTHÜR (C.). **Etudes de Lépidoptérologie comparée.** [A Comparative Study of the Lepidoptera.] —*Rennes*, x, March 1915, pp. 459, 42 figs.

This volume contains an account of the Lepidopterous fauna of Barbary, a few of the species described being of economic interest.

Papilio feisthamelii, Duponchel, has been found in the larval stage on the apple, peach and sloe. The eggs are laid on the under surface of the leaves. Two moults of the larvae, which hatch in about 8 days are described, as also is the pupal stage, from which the adult emerges in 14 days. *Vanessa polychloros*, L., was taken in large numbers from elms, acacias and poplars; elms have been completely defoliated by the larvae. The variety *erythromelas* lives on pear and cherry, occasionally on species of *Salix*.

Degrully (L.). **Contre la Pyrale.** [*Pyralis* control.]—*Progrès Agric. Vitic., Montpellier*, lxiii, (32nd year), no. 11, 14th March 1915, pp. 241–243.

To facilitate the destruction of *Sparganothis pilleriana* by crushing, M. Et. de Courtois, of Arles, has constructed an instrument consisting of a pair of pincers, the jaws of which are kept closed by a spring, and to which two flat iron plates are attached. The instrument is said to be very efficient. If the insects appear before the date when anti-cryptogamic treatment becomes useful, special sprays may be necessary. The cheapest is a solution of sodium arsenate of from 1 per thousand to 1·25 per thousand. This may cause scorching — usually of no importance, but to avoid this a solution of lead arsenate, consisting of 3 per thousand of sodium arsenate and 9 per thousand of neutral lead acetate, may be used. If it be desired to combine a copper treatment with the insecticide, the following is a good and economical formula: dissolve 4½ lb. copper sulphate in about 16 gals. water, add ½ lb. of sodium arsenate, and stir well; neutralise with weak milk of lime or sodium carbonate and make up to 24 gals. The employment of insecticides must in no way be regarded as obviating the necessity for the use of mechanical methods of destruction.

Lesne (P.). **La lutte contre l'Eudémis et la Cochylis.** [The campaign against *Polychrosis botrana* and *Clysia ambiguella*.]—*Jl. d'Agric. pratique, Paris*, xxviii, no. 38, 11th March 1915, pp. 263–264.

A big Algerian vine-grower, M. Paul Videau of Sidi-Aïd, has for two years successfully applied the following method against vine moths:— Instead of pruning the vine at the second knot, he prunes at the eighth or ninth or even at one metre, just as if it were intended to avoid frost injury. Once the vine has grown and the grapes appear, the flight and oviposition of the moths are watched, and on the disappearance of the moths the vine is pruned down to the second knot. The débris must be collected and burnt. In his district (Mitidja), M. Videau advises that this latter pruning be carried out from the 15th to the 20th April at the latest, or even at the end of March in certain years.

Trabut (—). **La Lutte contre les Sauterelles.** [The campaign against Locusts.]—*Bull. Agric. Algér. Tun. Maroc., Algiers*, xxi, no. 3, March 1915, pp. 53–74, 12 figs.

This paper is a summary of present day knowledge regarding locusts in Algeria and the methods of control employed against them there.

Serious injury is due to the two species, *Schistocera peregrina* from the interior of Africa and *Dociostaurus* (*Stauronotus*) *maroccanus* normally found in the Algerian steppes. Up to the present, mechanical control only has been employed in Algeria, but in the outbreak now expected both chemical and biological methods are to be tried. Modifications of the Cyprus barrier are described, and it is suggested that strips of thin ($\frac{1}{125}$ of an inch) aluminium, $2\frac{1}{2}$ inches high, might advantageously replace the strips of oilcloth which lose their gloss and then no longer keep back the hoppers. Such aluminium strip is commercially obtainable at about $1\frac{1}{2}$*d.* per yard. The shirting used in the apparatus might be replaced by cheap, coarse fabrics steeped in an emulsion made up of 4 quarts water in which 2 lb. of fuller's earth has been stirred, 2 lb. of oil being added to the mixture. These steeped fabrics are less likely to be stolen by the natives. The following parasites of locusts are mentioned :—Diptera : *Stomatorrhina* (*Idia*) *lunata*, F. (*fasciata*, Meig.), *Chortophila cana*, Macq., *Anthrax fenestratus*, Fall., *Chrysopilus nubecula*, Fall., *Sarcophaga clathrata*, Meig., *S. carnaria*, L. (*atropos*, Meig.), *S. cruentata*, Meig., *S. affinis*, Fall., and *S. haemorrhoidalis*, Fall. (*nurus*, Rond.). Coleoptera : *Mylabris schreiberi*, Reiche, *Trichodes ammios*, F., *T. umbellatarum*, Oliv.

NOEL (P.). **Les Ennemis de l'Avoine** (*Avena*, **L.**). [The enemies of oats.]—*Bull. Trim. Lab. Entom. Agric. Seine Infér., Rouen*, pt. 1, January-March 1915, pp. 4–7.

The following list of insect enemies of oats is given :—Coleoptera : *Agriotes segetis*, Gyll., *Lema cyanella*, L., *Lema melanopa*, Hbst. Thysanoptera : *Thrips cerealium*, L., *Thrips decora*, L. Orthoptera : *Phasgonura* (*Locusta*), *cantans*, Fuess. Rhynchota : *Aphis cerealis*, Kalt., *Aphis avenae*, F., *Sipha graminis* [*sic*], *Aphis fuscifrons*, Koch, *Typhlocyba aurata*, L. Hymenoptera : *Cephus pygmaeus*, L. Lepidoptera : *Satyrus dryas*, Sc. (*phaedra*, L.), *Augiades* (*Hesperia*) *sylvanus*, Esp., *Euxoa* (*Agrotis*) *tritici*, L., *Aphelosetia* (*Elachista*) *bedellella*, Sircom, *A. truncatella*, H. S., *A. pullicomella*, Zell., *A. pollinariella*, Zell., *Phlyctaenodes* (*Loxostege*) *sticticalis*, L. Diptera : *Oscinis devastatrix*, Fll., *Oscinis pusilla*, Fll., *Oscinella* (*Oscinis*) *frit.*, L., *Chlorops cereris*, Meig., *Chlorops messoria*, Meig., *Chlorops guerinii*, Meig., *Mayetiola avenae*, Marchal, *Contarinia ballotae*, Kieff., *Agromyza nigritarsis*, Meig. Acari : *Eriophyes tenuis*, Nal., *Tarsonemus spirifex*, Marchal Nematodes : *Tylenchus devastatrix*, Kahn., *Cephalobus rigidus*, Sch., *Heterodera radicicola*, Greeff.

NOEL (P.). **Les Ennemis du lin.** [The enemies of flax.]—*Bull. Trim. Lab. Entom. Agric. Seine Infér., Rouen*, pt. 1, January-March 1915, pp. 9–11.

The insect pests of flax include :—Coleoptera : *Melolontha melolontha*, L., *Haltica euphorbiae*, F., *Psylliodes chrysocephala*, F. Lepidoptera : *Phytometra* (*Plusia*) *gamma*, L., *Polia* (*Mamestra*) *pisi*, L., *Xylina* (*Calocampa*) *exoleta*, L., *Eupithecia linariata*, F., *Phalonia* (*Conchylis*) *epilinana*, Zell.

MOSSÉRI (V. M.). **Les Sauterelles en Egypte.** [Locusts in Egypt.]—*Bull. l'Union des Agriculteurs d'Egypte, Cairo,* no. 110, January-March, 1915, pp. 4–29.

This paper was first published in 1904 at the time of a locust invasion similar to that which has recently occurred in Egypt, and gives a general account of the usual methods of locust control. The direction of migration is dependent on the wind. In the destruction of locusts, natural enemies play an important part, especially the Bombyliid fly, *Callostoma*, which may destroy as much as 40 per cent. of the eggs. The non-appearance of locusts in certain years is undoubtedly due to these. The article concludes with some observations by the Minister of Agriculture. The places where eggs are deposited are usually the banks of railways or canals, and these should be watched and distinctly marked by the local authorities. High and sandy places, on the edge of cultivated land, are also suitable for egg-laying. Ground, in which eggs have been deposited, should be ploughed so that the egg-masses may be exposed to the sun or collected and burnt. A fixed sum is paid for all eggs collected. All possible precautions should be taken against young locusts, which pass towards cultivated ground as soon as they hatch; a trench with the side perpendicular in the direction of advance should be dug and the locusts led as far as possible into this. All the available population should be urged to cooperate in the work.

SCELSI (S.). **La Pasta Caffaro.** [The "Caffaro Paste" insecticide.]—*Riv. Agric., Parma,* xxi, no. 11, 12th March 1915, pp. 169–170.

The "Pasta Caffaro" manufactured in Italy and sold in barrels of 1 and 2 cwt. is said to be an excellent fungicide. It is an oxychloride of copper treated with lime, being a paste in which oxychloride of copper replaces sulphate of copper. Its percentage composition is stated to be: Metallic copper, 16·51; lime, 8·39; chlorine, 17·50; combined oxygen, 3·60. Each barrel contains a measure for the paste, which only needs diluting in 100 parts (by weight) of water; the solution is said to be more adhesive than Bordeaux mixture. If it is desired to mark the sprayed foliage, 1 oz. of lime paste may be added to every 3 gals. of solution; this amount must not be exceeded or the efficiency of the preparation is impaired and injury may be caused.

ELEGI ( ). **Contro l'afide lanigero del melo.** [Control of the woolly aphis of the apple.]—*Riv. Agric., Parma,* xxi, no. 13, 26th March 1915, p. 197.

"Nessler" solution is recommended against *Eriosoma lanigerum*; its formula is:—Soft soap, 40 parts (by weight); amyl alcohol, 50 parts; phenicated tobacco extract, 25 parts; commercial alcohol, 200 parts; water, 1,000 parts. [See also this *Review*, Ser. A, ii, p. 77.]

RIZZO (A. F.). **La lotta naturale contra la mosca delle olive.** [Natural control of the olive fly.]—*Il Picentino, Salerno,* iv, nos. 3–4, March-April 1915, pp. 165–167.

In the course of a popular account of this pest, it is stated that *Dacus oleae* (the olive fly) causes an average annual loss of £8,000,000 to Italian olive-growers.

Del Guercio (G.). **Results of the First Experiments with Polysulphides strengthened with Flour Paste in the Control of** *Chrysomphalus dictyospermi* **var.** *pinnulifera* **on Citrus Trees.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome,* vi, no. 3, March 1915, pp. 474–475. [Abstract from *Riv. Patologia vegetale, Pavia,* vii, no. 5, pp. 129–135.]

In this preliminary report of spraying experiments made in 1914 for the control of *Chrysomphalus dictyospermi* var. *pinnulifera,* Mask., it is stated that the addition of 1 or 2 per cent. of flour paste, fish glue, etc., increased the efficiency of the polysulphides employed. At present, rye flour answers best, being inexpensive and most tenacious, but damaged wheat or other flour can also be successfully used. Insecticides thus prepared always wet completely and uniformly. The protecting shields of the scale-insect remain as if glued to the plant, so that the larvae and eggs perish beneath the mother scale. The most active polysulphide is that of potash, even in amounts of less than 1 per cent. for the control of the larvae, and at from 5 to 7 per cent. for the adult scale; in July, its action on the adults is apparent from the second day, while the larvae are killed almost instantaneously. This polysulphide, when strengthened with flour, owes its increased destructive power to its remarkably hygroscopic nature; during the night and early morning it absorbs moisture from the air, and its injurious effects on the scale-insects are renewed, while during the day and until night-fall its action is lessened. This circumstance is most fortunate, since it is thus easy to avoid scorching and injury from the sun's rays, which readily takes place in the southern parts of Italy and especially in Sicily. The liquid, however, loses its efficacy if the plants are washed by heavy rains immediately after spraying. Polysulphide of soda is much less effective than the potash compound; the impurities which accompany it also prohibit its use. Polysulphide of lime, alone, does not adhere well to very young shoots and leaves, or to green branches or fruit; it adheres better to old citrus leaves, but never wets them evenly. Even when strengthened with glue or flour, it has never the swift effect of polysulphide of potash, nor is it so efficacious, being deficient in the latter's hygroscopic property and not giving rise to the same chemical changes. On the other hand, it retains its protective property longer, since it is less easily washed off by rain. Double polysulphides strengthened with flour were obtained by mixing together the polysulphides of potash and lime, plus the viscous substance. These mixtures possess the properties mentioned in the case of their ingredients. Organic polysulphides prepared from polysulphide of potash and soap are apparently as efficacious insecticides as polysulphide of potash with flour paste, but their protective action does not last so long.

The following papers are abstracted from the *Bolletino del Laboratorio di Zoologia Generale e Agraria della R. Scuola Sup. d'Agric. in Portici, Portici,* 1914–1915, ix. [Received 21st April 1915.]

Martelli (G.). **Notizie su due Coccinellidi micofagi.** [Notes on two mycophagous Coccinellids.]—pp. 151–160.

Both *Halyzia* (*Thea*) 22-*punctata,* L., and *Halyzia* (*Vibidia*) 12-*guttata,*

Poda, are exclusively mycophagous insects. The Dipteron, *Aphiochaeta (Phora) fasciata*, Fall., and the Chalcid, *Homalotylus flaminius*, Dalm., considerably reduce the numbers of the former.

Martelli (G.). **La mosca delle arance (*Ceratitis capitata*, Wied.) vive nei nostri limoni?** [Will *Ceratitis capitata*, Wied., live in our lemons?]—pp. 161–164.

The eggs of *Ceratitis capitata*, Wied., were artificially introduced into lemons, some of which were still green and others nearly ripe, care being taken to allow the oil exuding from the punctures to dry first. On hatching, the larvae emerged from the punctures and died after wandering about for some hours. In the case of mandarins and ripe oranges, the larvae burrowed into the mesocarp, but died before reaching the pulp. Adult *Ceratitis* were enclosed in gauze bags with lemons growing on the tree; none of the fruit, some of which was still green, showed puncture marks or any abnormality which could be attributed to the fly.

Martelli (G.). **Alcuni esperimenti con l'*Eccoptogaster* (*Scolytus*) *amygdali*, Guér., l'*E. rugulosus*, Ratz., e l'*E. pruni*, Ratz., ritenuti rispettivamente parassiti determinanti la morte del mandorlo, pesco e prugno.** [Some experiments with *Eccoptogaster* (*Scolytus*) *amygdali*, Guér., *E. rugulosus*, *Ratz.*, and *E. pruni*, Ratz., believed to be parasites respectively causing the death of the almond, peach and plum.]—pp. 165–170.

The deaths of almond, peach and plum trees have been attributed to *Scolytus amygdali*, Guér., *S. rugulosus*, Ratz., and *S. pruni*, Ratz., respectively, but the results of a series of experiments, detailed in this paper, show that these insects only accelerate the death of trees already injured by gummosis and root-rot. These beetles cause the exudation of gum in the same way as any mechanical agency, but cannot be held responsible for the spread of gummosis. Healthy plants, on the other hand, resist beetle attack. Both *S. amygdali* and *S. pruni* have delicate senses, enabling them to find the diseased trees which alone are suitable for breeding places.

Weise (J.). **Chrysomeliden und Coccinelliden aus Erythraea.** [Chrysomelids and Coccinellids from Eritrea.]—pp. 227–233.

The following new Chrysomelids and Coccinellids sent from Eritrea by Prof. Silvestri are described:—*Argopistes silvestrii*, *Exochomus cherenensis*, *Hyperaspis mercki*, Muls., var. *compacta* nov., and *Nephus vetustus*.

Silvestri (F.). **Contributo alla conoscenza degli insetti dell' olivo dell' Eritrea e dell' Africa meridionale.** [A contribution to the knowledge of the insects of the olive in Eritrea and South Africa.]—pp. 240–334, 78 figs.

The author was in Eritrea in August and September 1914 for the purpose of collecting parasites of *Dacus oleae* [see this *Review*, Ser. A, iii, p. 173], and the present paper is a systematic record of a number

of insects which occur on the olive (*Olea chrysophylla*) in that region; it also includes a few species taken from *Olea verrucosa* in South Africa in March 1913, all the others being from Eritrea. Thysanoptera: *Phloeothrips oleae*, Costa. Hemiptera. TINGITIDAE: *Cysteochila pallens*, Horvath; *C. sordida*, Stäl, in Cape Colony; *Euphyllura aethiopica*, sp. n.; *E. longiciliata*, sp. n., in Cape Colony. ALEURODIDAE: *Siphoninus finitimus*, gen. et sp. n. COCCIDAE: *Phenacoccus oleabius*, sp. n., *Philippia chrysophyllae*, sp. n., *Saissetia oleae*, Bern., *Aspidiotus oppugnatus*, sp. n., *Chrysomphalus opimus*, sp. n., *Selenaspidus articulatus*, Morg., *Chionaspis olivina*, Leonardi. Neuroptera. CHRYSOPIDAE: *Chrysopa* sp., *Sympherobius amicus*, Navás. Lepidoptera. Besides the species recorded below, larvae of SATURNIIDAE, SPHINGIDAE and PSYCHIDAE were collected on *Olea chrysophylla*, but there was no time to breed them and the species were therefore not determined. TORTRICIDAE: *Carposina chersodes*, Mey. HYPONOMEUTIDAE: *Prays chrysophyllae*, sp. n. LYONETIIDAE: *Oecophyllembius inferior*, sp. n. Coleoptera. COCCINELLIDAE: *Chilocorus distigma*, Klug, which preys on *Chionaspis olivina*, Leon; *Nephus vetustus*, Weise. CHRYSOMELIDAE: *Argopistes silvestrii*, Weise. CURCULIONIDAE: *Anchonocranus oleae*, Marshall, in Cape Colony and Transvaal; *A. oleae*, Marshall, var. *pallida*, nov. in Eritrea. Hymenoptera. PROCTOTRUPIDAE: *Alloxista peraperta*, sp. n., a parasite of *Euphyllura aethiopica*, Silv. CHALCIDIDAE: *Eurytoma oleae*, sp. n.; *E. varicolor*, sp. n.; *Decatoma aethiopica*, sp. n.; *Ormyrus striatus*, Cam., which was found both in Cape Colony and Eritrea; *Eupelmus spermophilus*, sp. n.; *E. saissetiae*, sp. n., a parasite of *Saissetia oleae*, whether primary or secondary is unknown; *E. afer*, Silv., a parasite of *Dacus oleae*. (A key is given, by which these three species of *Eupelmus* may be distinguished between themselves and from *E. urozonus*, Dalm., which, in Europe, parasitises various insects, including *Dacus oleae*.) *Eurytoma oleae*, *E. varicolor*, *D. aethiopica*, *O. striatus*, *Eupelmus spermophilus* and *Habrocytus indagans*, sp. n., all develop within the stone of *Olea chrysophylla*, whence they emerge as adults, the first being probably parasitised by the other five. *Bothriothorax oleae*, sp. n., and *B. minor*, sp. n., both parasites of *Saissetia oleae*. *Homalotylus vicinus*, sp. n., a parasite of the larvae of *Nephus vetustus*, Weise. *Aphycus praevidens*, sp. n., parasitic on *Philippia chrysophyllae*. *Chiloneurus obscurus*, sp. n., parasitic on *Saissetia oleae*. *Habrolepis oppugnati*, sp. n., a parasite of *Aspidiotus oppugnatus*. *Diversinervus elegans*, gen. et sp. n., a parasite of *Saissetia oleae*, though whether primary or secondary is unknown. *Allocerellus inquirendus*, gen. et sp. n. *Halticoptera daci*, Silv., a parasite of *Dacus oleae*. *Scutellista cyanea*, Motsch., var. *obscurata* nov., a parasite of *Saissetia oleae*. *Eutelus modestus*, Silv., from galleries of *Dacus oleae* larvae. *Pachyneuron longiradius*, sp. n., and *Euryischia leucopidis*, sp. n., parasites of *Leucopis* sp., the larvae of which feed on the eggs of *Philippia chrysophyllae*. *Atoposoma variegatum*, Masi, var. *afra*, Silv., from galleries of *Dacus oleae* and *Oecophyllembius inferior*, Silv. *Allomphale cavasolae*, Silv., an ectophagous parasite of *Dacus oleae* larvae. *Achrysocharis formosa*, Westw., var. *meridionalis*, Silv. (in Cape Colony), parasite of small larvae of *Dacus oleae*. *Teleopterus notandus*, Silv., a parasite of the eggs and young larvae of *Dacus oleae*. *Metriocharis viridis*, Silv., and *M. atrocyanea*, Silv., are perhaps parasites of *Dacus oleae*.

Aphelinus erythraeus, sp. n., a parasite of *Aspidiotus oppugnatus*. *Encarsia siphonini*, sp. n., a parasite of *Siphoninus finitimus*. *Coccophagus eleaphilus*, sp. n., a parasite of the third stage larvae of *Philippia chrysophyllae*. *Euxanthellus philippiae*, gen. et sp. n., taken from adult females of *Philippia chrysophyllae*. *Tetrastichus gravans*, sp. n., from second stage larvae of *Philippia chrysophyllae*. *T. maculifer*, Silv., from olive-fly galleries. *T. sicarius*, sp. n., a parasite of *Chionaspis olivina*. *Zorontogramma distinctum*, gen. et sp. n., host unknown. BRACONIDAE: *Opius africanus*, Szépl. (in Cape Colony and Transvaal), *O. africanus*, Szépl. var. *orientalis*, Silv., *O. dacicida*, Silv., and *Sigalphus daci*, Szépl. (in Transvaal and Eritrea), all endophagous parasites of *Dacus oleae*; *Bracon celer*, Szépl., an ectophagous parasite of *D. oleae* larvae (Cape Colony and Eritrea). The paper concludes with a description of *Cysteochila pallens*, Horvath, sp. n., *Sympherobius amicus*, Navás, sp. n., and *Carposina chersodes*, Meyrick, sp. n.

SILVESTRI (F.). **Descrizione di nuovi Imenotteri Calcididi africani.** [A description of new African Hymenoptera Chalcididae.] — **pp. 337–377, 29 figs.**

In this paper the following 19 species of parasitic Hymenoptera are described, being from Eritrea, except where otherwise stated:—*Eurytoma spermophaga*, sp. n., taken from berries of an undetermined plant, the seeds of which are attacked by the larvae. *Eurytoma elongatula*, sp. n., and *Encyrtonotus notabilis*, gen. et sp. n., from the same berries. *Zeteticontus abilis*, gen. et sp. n., from French Guinea, parasitising the larvae of NITIDULIDAE (gen. *Carpophilus* ?) in fallen fruits. *Blastothrix subproxima*, sp. n., a parasite of the female of a *Pseudococcus* living on *Acacia* sp.; *Leptomastix superbus*, sp. n., and *Prochiloneurus pulchellus*, gen. et sp. n., parasitic on the female of a *Pseudococcus* living on Graminaceae. *Aëthognatus afer*, gen. et sp. n., from the Gold Coast, taken from adult females of *Stictococcus diversiseta*, Silv. *Coccophagus orientalis*, How., var. *modesta* nov., from Dahomey, taken from adults of *Lecanium* (*Saissetia*) *nigrum*. *Coccophagus princeps*, sp. n.; *Prococcophagus varius*, gen. et sp. n.; *Physcus seminotus*, sp. n., a parasite of *Chionaspis* sp. living on *Aloe*; *Azotus elegantulus*, sp. n., a parasite of females of *Chionaspis* sp. living on *Aloe*. *Encarsia parvella*, sp. n., and *Eretmocerus diversiciliatus*, sp. n., from Nigeria, parasites of ALEURODIDAE; the Coccinellid, *Serangium giffardii*, Grandi, destroys large numbers of *E. diversiciliatus*, sp. n. *Pelorotelopsella nigeriensis*, sp. n., from South Nigeria, obtained from a twig covered with *Stictococcus sjostedti*, Ckll., but whether a primary or secondary parasite is uncertain; the *Stictococcus* was also attacked by the larvae of a Dipteron and by that of the Lepidopteron, *Eublemma ochrochroa*, Hmpsn., the latter being itself attacked by an *Elasmus*. *Tetrastichus stictococci*, sp. n., from the Gold Coast, a parasite of the females of *Stictococcus diversiseta*, Silv., though whether a primary or secondary parasite is unknown. *Tetrastichus giffardianus*, sp. n., from South Nigeria and Dahomey, a parasite of *Ceratitis giffardii*, Bezzi. According to Fullaway, this *Tetrastichus* oviposits in *Ceratitis* larvae, and it is hoped to acclimatise it in the Hawaiian Islands. *Tetrastichus dacicida*, sp. n., from Kamerun, a parasite of *Dacus bipartitus*, Graham; the life-history of this species is probably similar to that of *T. giffardii*.

SILVESTRI (F.). **Contribuzione alla conoscenza del genere *Stictococcus*, Cockerell (Hemiptera: COCCIDAE).** [A contribution to the knowledge of the genus *Stictococcus*.]—pp. 379–388, 9 figs.

The author describes all the forms of *Stictococcus diversiseta*, sp. n., which he found in the Gold Coast on branches and fruit of *Anona* and on an undetermined plant in Dahomey. Females yielded the parasites *Aëthognatus afer*, Silv., and *Tetrastichus stictococci*, Silv. The author approves of Lindinger's erection of this genus as the representative of a new subfamily, STICTOCOCCINAE, as more exact than placing it among the LECANIINAE, as suggested by Cockerell, or among the MARGARODINAE, as done provisionally by Newstead.

MANTERO (G.). **Experimento sulla nascita in Liguria degli adulti (da pupe ibernanti) del *Dacus oleae*.** [An experiment on the emergence in Liguria of the adults (from hibernating pupae) of *Dacus oleae*.] —p. 389.

About fifty fallen olives infested by *Dacus oleae* were collected on the 28th December 1913 and placed in a jar containing earth. Early in January 1914, 22 pupae were found, which were kept in sterilised earth in a glass tube. The tube was stored in an unwarmed room, the earth being wetted from time to time. The first adult appeared on the 23rd March and the last on the 4th April. These observations, made in Liguria, agree with those of Silvestri and Martelli in South Italy.

LEEFMANS (S.). **De Theezaadvlieg.** [The Tea-seed Fly.]—*Mededeellingen v. h. Laboratorium v. Plantenziekten* no. 12. *Mededeelingen van het Proefstation voor Thee*, no. XXXV, March 1915, 15 pp. 2 plates. [*sine loco.*]

Damage to tea-seed has, on investigation, proved to be due to a Trypetid fly, which, according to Professor de Meijere, is *Adrama determinata*, Walk. The habits of the fly were studied on a tea-estate at an elevation of 3,600 feet in West Java. They were observed to be attracted by tea-seeds, which, after being tested by the water method, were dried in a shady place, before being packed and exported. Flies were put in a cage with: (1) Unripe, green tea-fruits; (2) not yet germinated and therefore not yet opened seeds; and (3) germinated seeds. After a week maggots were found in the germinated seeds; the green tea-fruits and not yet germinated seeds were free from infestation. Some pairs of the flies were then put into cages with germinated seeds of which the lobes were already visible. Soon afterwards oviposition was observed. The egg is inserted into one of the lobes of the seed by means of the ovipositor. The maggots tunnel through the seeds in all directions, and within 9–12 days are full-grown and at that time measure 7–8½ mm. They then leave the seeds and pupate in the soil. The length of the whole life-cycle is 26 or 27 days. In seeds not yet opened by germination no larvae were found, and the female flies are apparently unable to penetrate the hard shell. The fl es never tried to penetrate into the soil, and seeds covered with a layer of soil of 1 inch and even ⅕ inch, were not infested. Planters,

therefore, are advised to take care that the seeds, when planted, are always covered with soil. Care must be taken also in planting already germinated seeds received from other plantations; such seeds should first be planted under fine meshed wire gauze and any flies that appear killed. Hitherto this pest has only been detected on two tea-estates, but it is considered possible that it occurs elsewhere, the damage to the seeds being attributed to fungus disease.

TULLGREN (A.). **Potatisodlingens viktigaste fiender inom djurvärlden.** [The most important potato pests.] *Trädgården, Stockholm,* March 1915, h. 3, p. 8486, 2 figs.

This is a short review of the most important insect enemies of potatoes in Sweden and deals with wireworms, the larvae of cockchafers, cutworms, Tipulids, *Hydroecia micacea*, Esp., *Lygus pabulorum*, Mey., [*sic*] and *Blaniulus guttulatus*, Gerv.

TRÄGÅRDH (I.). **Hvarpå beror bladminerarnes förmåga attom hösten konservera klorofyllet i bladen?** [On what depends the ability of the leaf-miners to preserve the green colour in the autumn mines?] —*Skogsvårdsföreningens Tidskrift, Stockholm,* March 1915, h. 3, pp. 179–190, 5 figs.

In order to test the generally accepted hypothesis of Wood, that leaf-miners produce some preservative substance in order that the part of the leaf occupied by the mine should retain its green colour a long time after the rest of the leaf has withered, the author examined two mines of different types found on oak leaves—viz., those of *Lithocolletis* sp. and of *Nepticula subbimaculella*. The anatomy of the mines and their mode of construction was investigated, and the conclusion was arrived at that there is no necessity to assume the existence of any preservative substance produced by the leaf-mining larva in order to explain the persistence of the green colour in the mines and that this phenomenon is brought about by the damage done to the vascular system at a period when the sap is flowing back from the leaves to the trunk.

TRÄGÅRDH (I.). **Barrtradskvalstret** (*Paratetranychus ununguis* **Jac**). [The pine-tree spinning-mite.] —*Skogsvardsföreningens Tidskrift, Stockholm,* March 1915, pp. 242–246, 1 fig.

The eggs of this species hibernate in crevices of the bark and hatch at the beginning of May, about four generations occurring during the summer. It attacks pine, fir and larch. Attacks have been recorded from nurseries near Båstad in July 1914, when *Picea excelsa*, *P. alba*, *P. sitchensis* and *P. engelmanni* were damaged, and from Reftele, where, at the same time, 5–6-year old plants of *Picea alba* were injured. *P. ununguis* is also found in forests under circumstances which prove that it is indigenous to Sweden. Spraying with soap emulsion or quassia-nicotine emulsion is recommended; larches may be sprayed in winter with 5 per cent. carbolineum.

SCHNEIDER-ORELLI (O.). **Ueber den Zeitpunkt der Neuansteckung von Obstbäumen durch Borkenkäfer.** [The moment of re-infestation of fruit trees by bark beetles.]—*Schweiz. Zeitschr. Obst- u. Weinbau, Frauenfeld*, xxiv, no. 5, 8th March 1915, pp. 65–67, 1 fig.

The injury done by the bark beetles, *Xyleborus dispar*, *X. xylographus* (*saxeseni*), *Scolytus pruni* and *S. rugulosus* is illustrated and the various dates of the appearance of the adults of these species in Switzerland are given. After ascertaining the species concerned, reference to the list of dates will permit of efficient protection of the threatened trees by wrapping their trunks and larger branches in packing material after they have been smeared with clay. Badly infested trees should be used for fuel some time before the date of the appearance of the adults.

SCHNEIDER-ORELLI (O.). **Blutläuse.** [Woolly Aphids.]—*Schweiz. Zeitsch. Obst- u. Weinbau, Frauenfeld*, xxiv, no. 6, 20th March 1915, pp. 85–86.

The author confirms his statement that a 3 per cent. solution of soft soap is an efficient insecticide [see this *Review*, Ser. A, iii, p. 387] and disputes the contention that high pressure and correct date of application are of the greatest importance, while the composition of the spray solution is a subordinate factor. According to Golaz, if a good fluid spray is thrown with high pressure from a nozzle placed close to the infested spots, good results will be obtained, as the wax coat will be washed away and the insects exposed ; a weak solution may be used and the cost of control reduced thereby. The author observes that a stream of water at high pressure would disperse the insects in other directions, while the object of spraying is to destroy the pests.

OBERSTEIN (O.). *Chortophila trichodactyla* **(Diptera), injurious to young Cucumber Plants and new to Lower Silesia.**—*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, vi, no. 3, March 1915, p. 478. [Abstract from *Zeitschr. für Pflanzenkrankheiten, Stuttgart*, xxiv (1914), no. 7, 1915, pp. 385–388.]

In May 1913 and 1914, young cucumber plants were sent to Breslau from two localities in Lower Silesia where they were being injured by an insect which was found to be the Anthomyid, *Chortophila trichodactyla*, Rond. The life-history of this insect is not yet perfectly known ; it is new to Lower Silesia, where no fly had previously been recorded as attacking cucumbers. At Lampersdorf, the infected plants amounted to about 80 per cent. in the half acre field whence the specimens were sent. The land had been heavily manured. The seedlings were said to have died after a few days, their stalks containing small larvae. In neighbouring fields few plants were injured and a very late replanting of the damaged patches was moderately successful. In 1913 and 1914, the author reared these larvae. Pupation took place in the soil, and in 1913 began on 31st May, the adults appearing from the 9th to the 12th June As pungent odours are usually attractive to Anthomyids, the use of fresh stable manure should be avoided. Experience will show if the other controls advised against ANTHOMYIDAE in general, and especially treatment with petroleum emulsions, are efficacious against this species of *Chortophila.*

Uvarov (B. P.). **Очерки по борьбѣ съ саранчевыми насѣкомыми.** [Essay on the campaign against locusts.]—**«Сельское Хозяйство и Лѣсоводство.»** [*Journal of Agriculture & Forestry*], *Petrograd*, nos. 2 and 3, February and March 1915, pp. 266–281, 377–414.

The most important locust in Russia is *Locusta* (*Pachytylus*) *migratoria*, L., which is indigenous on the lower reaches of some South Russian and Central Asian rivers. In recent years they infested the deltas of the large rivers of the Black Sea, Danube, Dnieper, Don and Kuban, but, for reasons which are not yet investigated, the outbreaks have now ceased there and, although still commonly found, they concentrate now along the rivers of the Caspian and Aral Seas, Volga, Ural, Kuma, Terek, Araxes, Syr-Daria and Amu-Daria, etc. Another species of importance is *Dociostaurus* (*Stauronotus*) *maroccanus*, Thunb., which is abundant in the steppes of Turkestan, Transcaucasia and North Caucasia; in the last locality the pest has been reduced during recent years by increased cultivation, only virgin and hard soil being suitable for its oviposition. *Calliptamus italicus*, L., is found in South and Central Russia, everywhere in Asia, and in Caucasia, but its importance as a pest is decreasing, for the same reasons as in the case of *D. maroccanus*. Other species of locusts found most frequently in East Russia and in West Siberia, are: *Arcyptera flavicosta*, Fisch., *A. fusca*, Pall., *Gomphocerus sibiricus*, L., and *Stauroderus scalaris*, Fisch. (*Stenobothrus morio*, Brunn). The usual methods of control are described. The biological method is referred to as still requiring further investigation and the chemical method is declared to be the most effective and profitable under present conditions.

Kurdiani (S. Z.) & Iliinski (A. P.). **Изъ біологіи лѣтняго дуба.** [On the biology of summer-oak, *Quercus pedunculata*, Erch. (*Q. robur*, L.).]—**«Сельское Хозяйство и Лѣсоводство.»** [*Agriculture & Forestry*], *Petrograd*, ccxlvii, no. 3, March 1915, pp. 415–429, 3 figs.

The authors describe their observations on the biology of oak trees, conducted in Novo-Alexandria (government of Lublin), the object of which was to investigate the adaptability of insects breeding on oaks to the peculiarities of the two varieties of oak most commonly found in European Russia—viz., *Quercus pedunculata*, Erch., var. *praecox*, and *Q. pedunculata* v. *tardiflora*, Czern. The first of these is in leaf in the middle of April, one to three weeks earlier than the second, the leaves falling in autumn, while the other variety retains them until the next spring. Owing to the war and the removal of the Institute of Novo-Alexandria from that place, part of the collected material still remains uninvestigated. On 23rd May, when the var. *praecox* had already flowered, a large number of insects were found on it, such as caterpillars of *Cheimatobia brumata*, L., and *Hibernia defoliaria*, L., which had already defoliated the branches and were descending to the earth to pupate; those of *Tortrix viridana*, L., a great majority of which had already pupated; pupae of *Coleophora*; galls of the Cynipid, *Neuroterus baccarum*, L., the insects having in the majority of cases already left; immature galls of *Andricus curvator*, Hartig, and clusters of

developed galls of *Dryophanta* (*Diplolepis*) *folii*, L., on the leaves. The var. *tardiflora*, which is considerably later, had not reached the same state of development and its buds were only just beginning to unfold on the 23rd May. Accordingly, its insect population was much less numerous and varied ; only a few specimens of caterpillars of *Coleophora* were found, the majority of them still in a state of winter torpor at the base of the buds and only a few of them having passed to the young leaves, which they mine, and to the male spikes. The young caterpillars feed on the pollen. Besides these, caterpillars of *Hylophila bicolorana* (*quercana*) and of some other species which had only recently hatched, were found. Intermediate varieties of oaks on the 23rd May showed the same conditions as regards the insects found on them ; caterpillars of *Coleophora* had already started to mine the leaves, and galls of *Andricus seminationis*, Giraud, were common on the male spikes. These differences in the condition of the several varieties of oak and of their fauna disappear rapidly, the intermediate and late varieties developing more rapidly than the early one. In the first half of June the early oaks were recovering from the defoliation caused by *C. brumata* and *H. defoliaria* ; *A. curvator* and *A. seminationis* were emerging ; the caterpillars of *Coleophora* and *H. bicolorana* were pupating on the late variety, which was then also attacked by several species of aphids ; the larvae of the weevil, *Orchestes quercus*, L., appeared on all three varieties, mining the leaves ; eggs of Psocidae occurred on all varieties, as well as the second generation of *Tortrix viridana*. From this time the difference in the fauna of the three varieties disappeared altogether.

Cheimatobia brumata, L., in Novo-Alexandria, is the most serious pest of fruit trees, attacking apple, pear, plum, cherry and various forest trees, especially oaks, hornbeams and lime trees. In the spring of 1914, a large outbreak of caterpillars of this pest occurred and great damage was done. Notwithstanding the severity of the outbreak, the late variety of oak, even when the trees were near totally defoliated ones, remained practically untouched, owing to the late unfolding and rapid development of its leaves. It was proposed to investigate also whether the insects oviposit on the late variety, but the war has prevented this ; it is, however, thought that even when this is the case, the caterpillars hatched out have to migrate to neighbouring trees, not finding any food on the late variety at that time. Although these observations are not concluded, they have shown that the late variety, besides being more adapted to withstand frost, is also comparatively less attacked by insects. The authors point out that late varieties of other trees also occur, and urge the necessity of further researches on these lines.

Fabrikant (A. O.). **Обзоръ земской дѣятельности по борьбѣ съ вредителями сельскаго хозяйства.** [A review of the work of the Zemstvos in combating pests of Agriculture]—**« Сельское Хозяйство и Лѣсоводство.»** [*Agriculture & Forestry*], *Petrograd*, 1915, no. 1, January, no. 3, March, pp. 142–166 and pp. 489–517.

The author reviews the work conducted by various Zemstvos in Russia as regards the control of pests of agriculture. This can be

divided into three parts scientific research, popularisation of knowledge concerning pests and remedies for them amongst the population, and the actual organisation of the control work. He gives a history of the origin of entomological and experimental organisations in various governments, and shows the growth and development which has taken place in this respect during late years with regard to the methods and amount of work, the funds assigned for these purposes, etc. In many governments the method of inviting temporary expert entomologists is practised, their work generally taking the form of an investigation of the fauna of the given locality ; this method is illustrated by the instances in governments of Tver and Ufa. The existing organisations cannot be regarded as adequate and an extension of them, as well as their improvement and development, is urged.

VASSILIEV (I. V.). **Два новыхъ вида трибы** *Telenominae*. [Two new species of the subfamily *Telenominae* (Hymenoptera, Proctotrupidae).]—**« Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, 31st March 1915, xv, no. 1, pp. 16 & 17.

This is a description of *Aphanurus eurydemae*, sp. n., a parasite of the eggs of *Eurydema ornatum*, L., *E. festivum*, L., and *Carpocoris purpureipennis*, Deg., which in 1913, in Astrachan, parasitised as much as 70 per cent. of the eggs of these pests, and of *Telenomus chrysopae*, sp. n., which resembles *T. acrobates*, Giard, and was found to have parasitised the eggs of a *Chrysopa* taken on the leaves of a cotton plant at Skobelev, in Fergana.

SCHREINER (J.). **Новый видъ рода** *Phyllotreta*, **Foudr.** [A new species of the genus *Phyllotreta*, Foudr.]—**« Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, 31st March 1915, v, no. 1, pp. 72–73.

This new species, which closely resembles *Phyllotreta turcmenica*, Weise (1900), was observed by the author in 1910 in the government of Astrachan on mustard, together with other species of *Phyllotreta*. It has been named *Phyllotreta schreineri* by G. G. Jakobson.

MJATLIK (A.). **Культура клубневыхъ бегоній.** [The cultivation of tuberous begonias.]—**« Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture & Market-Gardening*], *Petrograd*, 1915, nos. 7, 8 and 9, 28th February, 7th March and 14th March, pp. 212–215, 236–239 and pp. 275–277.

Great damage to begonias growing in the open is done by Elaterid larvae, which penetrate into the stems near the roots. Digging the soil, accompanied by picking and destruction of the larvae, is suggested. Bait plants, such as salad, appear to be of little use, as they are less attractive than the begonias themselves.

Zacharievskaja (A. V.). **Обзоръ инструкторской дѣятельности по садоводству въ Макарьевскомъ уѣздѣ Нижегородской губерніи.** [A review of the work of the Instructor of Horticulture in the Makarievsk district of the govt. of Nijni-Novgorod.]—**«Садъ и Огородъ.»** [*Orchard & Market-Garden*], *Moscow*, no. 3, March 1915, pp. 152–154.

The orchards of the Makarievsk district of the government of Nijni-Novgorod are stated to suffer from many pests, notably from *Psylla mali* and *Anthonomus pomorum.*

Schreiber (A. F.). **Борьба съ капустной бѣлянкой.** [The control of *Pieris brassicae.*]—**«Садъ и огородъ.»** [*Orchard & Market-Garden*], *Moscow*, no. 3, March 1915, pp. 140–142.

The author recommends growing tomatoes near cabbage beds to drive away the butterflies, and to use tomato-extract or an extract of *Veratum nigrum* and *V. album* as an insecticide against the caterpillars of *Pieris brassicae.* The last-named extract is being successfully used against these insects in the Trans-Baikal province in Siberia. Tomato extract is prepared by boiling leaves and stalks of tomatoes in water for at least 6 hours, till the extract turns a brown red colour, gradually adding water, as it evaporates; the leaves and stalks are then removed and the extract diluted in water and strained. The spraying must be done either between 7 and 10 a.m. or 5 and 7 p.m. and repeated next day.

Приглашеніе Энтомологовъ. [The appointment of Entomologists.] —**«Хозяйство на Дону.»** [*Husbandry on the Don*], *Novotcherkassk*, x, no. 5, 21st March 1915, p. 232.

This is a note of the appointment of two Entomologists, who will, in the first place, have to organise the campaign against *Oria* (*Tapinostola*) *musculosa* in the district of Taganrog, which this pest has invaded from the neighbouring government of Ekaterinoslav. *Eurygaster* sp. has also been very injurious recently in some of the forest districts.

Schreiber (A. F.). **Гласъ вопіющаго въ пустынѣ.** [A voice crying from the wilderness.]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*], no. 3, March 1915, pp. 178–180.

The control of *Byturus fumatus* and *B. tomentosus*, which are the most dangerous pests of raspberries and dewberries, by means of trap-crops round and near raspberry orchards, is advocated. The only existing method of control consists of handpicking the beetles in dull weather, when they are less active, and thus preventing oviposition. For trap-crops, representatives of the natural orders Rosaceae, Ranunculaceae and Scrophulariaceae, which are favoured by the beetles, are suggested. The beetles concentrate on these plants and can be easily destroyed there. The damage done to raspberry blossoms by the adults appears to be rare from the author's observations in the government of Vladimir. It is suggested that experiments should be made with insecticides, such as tomato or hellebore decoctions.

SCHREIBER (A. F.). **Вниманію садоводовъ и плодоводовъ.** [For the attention of horticulturists.]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 3, March 1915, pp. 180–182.

The author appeals to the horticulturists of Russia to assist him in his researches on the influence of the scent of various flowers on insects. He asks the following questions, amongst others: (1) Has it been noticed that Lepidoptera visit flowers with aminoidal scents (i.e. of amines), such as *Crataegus*, *Sorbus*, *Sambucus*, various species of *Spiraea*, *Cornus*, *Berberis*, *Clematis*, *Mespilus*, *Viburnum*, *Pyrus*, *Castanea*, etc.? (2) Do Lepidoptera and Hymenoptera visit flowers with indoloid scents (i.e., of indol), such as *Aristolochia*, *Calla*, *Acorus*, *Stapelia* and others, the odour of which resembles that of decomposing animal matter? All information is to be addressed to the author at Irkutsk, Siberia, Russia.

PURIN (I. I.). **Лучшіе сорта малины.** [The best sorts of raspberries.]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 3, March 1915, pp. 187–191.

It is stated that the yellow and orange-coloured varieties of raspberries, being sweeter, are more subject to the attacks of various pests, particularly of the larvae of *Byturus tomentosus*.

SCHREINER (J. F.). **Виноградный сверчокъ.** [*Oecanthus pellucens*, Scop.]—**«Садъ, Огородъ и Бахча.»** [*Orchard, Market-Garden & Bachza*], *Astrachan*, no. 2, February 1915, pp. 45–48. [Received 30th June 1915.]

The tree-cricket, *Oecanthus pellucens*, Scop., is found everywhere in South Europe, as well as in Senegambia, Algeria, Asia Minor, and Syria. In Russia it has been reported from a large area of the southern governments. The adults appear in the second half of summer and live on vines, various species of *Rubus*, etc. The females oviposit inside the stems of vines, the eggs remaining over the winter. The larvae feed mostly on aphids; they moult several times and are fully grown in August. The adults feed also on caterpillars of various Lepidoptera and on the larvae of Rhynchota, CEPHIDAE, etc. They have been observed to injure the leaves of tobacco and, probably, also of vines. This injury is, however, not important and is more than compensated for by their utility in destroying various pests. The case is, however, different with regard to the damage to vines, caused by the process of oviposition. The infested stems, owing to the numerous wounds, frequently wither or break. Thus, this insect is undoubtedly more injurious than useful and must be controlled by cutting away, in autumn and early in spring, the withered branches infested with eggs. The insect is briefly described and figured.

KUSZNETZOV (A.). **Одна изъ причинъ усыханія плодовыхъ деревьевъ.** [One of the causes of the withering of fruit-trees.]—**«Садъ, Огородъ и Бахча.»** [*Orchard, Market-Garden & Bachza*], *Astrachan*, no. 3, March 1915, pp. 92–94.

The oyster-shell scale, *Lepidosaphes ulmi*, L. (*Mytilaspis pomorum*,

Bouché), is a serious pest of fruit trees. A popular account of its life-history is given and the smearing of the trees, early in spring, with California mixture is recommended. Spraying with kerosene emulsion (2 lb. of green soap, 12 lb. of kerosene, in about 23 gallons of water) or with a 5 per cent. solution of kerosene in water, three times at intervals of 1 or 2 days, is also suggested.

Бюллетень о вредителяхъ сельскаго хозяйства и мѣрахъ борьбы съ ними. [Bulletins on pests of Agriculture and methods of controlling them.] Published by the Entomological and Phyto-pathological Bureau of the Zemstvo of the govt. of Charkov, *Charkov*, iii, no. 1, January 1915. 47 pp. [Received 15th May 1915.]

The following articles relating to Entomology appear in this number:—

VOSTRIKOV (P.). **Нѣсколько словъ о мышьяковисто-кисломъ натрѣ.** [A few words about sodium arsenite.] pp. 2–5.

Sodium arsenite, in the form of a ready-made insecticide, manufactured by a firm in Theodosia, consisting of 4 parts of sodium arsenite, 3 parts of water and 4 parts of sugar-molasses, was successfully tested during the campaign against *Locusta* (*Pachytilus*) *migratoria* in the government of Astrachan in 1914. During rainy weather this insecticide, 1 lb. in about 14 gallons of water, caused serious scorching of the reeds and sedges, while a solution of 1 lb. in about 20 gallons proved harmless in rainy weather, but not in fine. The death-rate amongst the locusts was 100 per cent. In hot weather, 1 lb. of the insecticide in 33–35 gallons gave good results in the damp climate of the delta of the Volga, but in a dry, steppe locality even this may prove dangerous. The application of this insecticide, besides the excellent results obtained, proved less troublesome than that of Paris green, and the cost was only one-tenth as much. To spray effectively $2\frac{3}{4}$ acres, 10 lb. of green against only 4 lb. of the above insecticide were required. The author thinks that this insecticide may prove useful in a solution of 1 lb. in 55–58 gallons of water against many other pests controlled hitherto with Paris green.

AVERIN (V.). **Краткій обзоръ вредителей наблюдавшихся въ 1914 году и возможность ихъ появленія въ 1915 г.** [A brief review of pests noticed in 1914, and the possibility of their appearance in 1915.] pp. 7–13.

The following pests of orchards are mentioned:—*Anthonomus pomorum*, L., was very injurious, destroying 20–60 per cent. of apple buds; *Rhynchites pauxillus*, Germ., defoliated a large number of trees; *Sciaphobus squalidus*, Gyl., was injurious to buds of cherry, plum, pear and apple trees, the damage increasing yearly; *Byturus tomentosus*, F., was first noticed in large numbers in the district of Valk; *Hyponomeuta mallinellus*, Zell., was injurious in many districts; *Cydia pomonella* does serious damage every year and is expected again in 1915; *Aphis pomi*, de Geer, and *Myzus cerasi* have done great damage to some orchards; *Gryllotalpa gryllotalpa*, L., injured roots of young plants in nurseries.

Pests of market-gardens include :—*Lethrus apterus*, Laxm., injuring sunflower seedlings; *Baris* sp., injurious to cabbage; *Melolontha melolontha*, L.; *Chortophila* (*Anthomyia*) *brassicae*, Bouché; *Gryllotalpa gryllotalpa* in many districts destroyed whole fields of cabbage; *Aphis brassicae*, L.; *Plutella maculipennis*, Curt. (*cruciferarum*, Z.).

Pests of field crops :—*Sitones* sp., injurious to vetches and lucerne; *Lema melanopa*, Pall., was specially harmful to barley and oats; *Anisoplia austriaca*, Herbst, has increased of late years; *Bothynoderes* (*Cleonus*) *punctiventris*, Germ., was formerly injurious in the western districts, but in recent years it has practically disappeared there and has now spread to the East and done considerable damage. *Agriotes* larvae and *Cassida nebulosa*, L., have done great damage to beet plantations. *Phlyctaenodes* (*Eurycreon*) *sticticalis*, L., as was expected, was not numerous in 1914, although in the district of Voltchansk, which suffered little in 1913, the caterpillars have considerably injured beet crops; it is not expected that an outbreak will occur this year. *Euxoa* (*Agrotis*) *segetum*, Schiff., has become a serious pest during the last two years and is expected to be so this year. *Oria* (*Tapinostola*) *musculosa*, Hübn., is again expected to be troublesome. *Athalia spinarum*, L., was noticed on rape and mustard.

Pests of trees and shrubs included : *Lithocolletis populifoliella*, Fr., which appeared in smaller numbers than in 1913; *Emphytus rufocinctus* damaged leaves of rose bushes near Charkov, the shoots being also injured by the larvae of *Ardis* (*Selandria*) *bipunctata*; *Hylotoma rosarum* was noticed in the district of Sumy, where roses have also suffered greatly from a large outbreak of *Aulacaspis* (*Diaspis*) *rosae*. *Lophyrus pini*, L., denuded many acres of pines in the districts of Achtyr and Izium.

WATERSTON (J.). **New Species of Chalcidoidea from Ceylon.** —*Bull. Entom. Research, London*, v, pt. 4, March 1915, pp. 325–342, 6 figs.

The new Chalcidoidea described in this paper were obtained at Peradeniya, Ceylon, by the late Mr. A. Rutherford, the Government Entomologist, and were forwarded by him to the Imperial Bureau of Entomology for identification. The following new species are described :—*Polycystus propinquus* and *Trigonogastra rugosa*, from the bean fly, *Agromyza phaseoli*, Coq.; *T. megacephala*, from a jak fruit which had been attacked by an undetermined insect; *Closterocerus insignis*, from the tea fly, *Oscinis theae*; *Sympiesis purpureus*, from *Acrocercops ordinatella*, Meyr., a leaf-miner of camphor; *Syntomosphyrum taprobanes* from a Coccinellid, *Scymnus* sp.; *Tetrastichodes asthenogmus*, taken on the egg-capsule of a cockroach.

WATERSTON (J.). **Notes on African Chalcidoidea. II.** —*Bull. Entom. Research, London*, v, pt. 4, March 1915, pp. 343–372, 17 figs.

The characters of the genus *Pleurotropis* are discussed, and it is suggested that these insects are all hyperparasites, and therefore probably harmful. A key to the African species is given and the following new ones described :—*Pleurotropis neavei*, from the pupa of a species of *Charaxes*, Nyasaland; *P. neavei*, var., from cocoons

of *Apanteles* sp., Bukoba; *P. clinognathus*, from *Synagris cornuta*, S. Nigeria and Gold Coast; *P. nigripes*, from cocoons of an undetermined Braconid, S. Nigeria; *P. amaurocoela*, from *Sylepta derogata*, F., Nyasaland; *P. homoea*, from larvae of *Busseola fusca*, Hmp., which is very destructive to maize, Nyasaland; *P. mediopunctata*, from the pupa of a Coccinellid, S. Nigeria; *P. africana*, from eggs of a Hemipteron (?), Nyasaland; *P. violaceus*, from eggs of a Lymantrid moth, *Heteronygmia leucogyna*, Hmp., which is very destructive to mahogany trees, Nyasaland; *P. illustris*, host not stated, S.W. Persia; *Syntomosphyrum phaeosoma*, from cocoon of a Braconid, *Apanteles* sp., parasitic on the leaf-roller of cotton, *Sylepta derogata*, F., N. Nigeria; *Tetrastichus melichlorus*, host not stated, Gold Coast.

MARSHALL (Guy A. K.). **Some Injurious Indian Weevils (Curculionidae).**—*Bull. Entom. Research, London*, v, pt. 4, March 1915, pp. 377–380, 4 figs.

The following species are described:—*Phytoscaphus dissimilis*, sp. n., attacking young shoots of tea in Assam. *Corigetus bidentulus*, Fst., a serious pest of tea in Assam. *Rhynchaenus* (*Orchestes*) *mangiferae*, sp. n., bores the leaves of the mango tree. It is described by Bainbrigge Fletcher as a minor pest of local importance. The eggs of *Pachytychius mungonis*, sp. n., according to Bainbrigge Fletcher, are laid in a hole bored in a seed of green gram (*Phaseolus mungo*) or cow-pea, the female having previously eaten her way inside the pod. Three eggs are usually laid in one pod, one at each end and the third in the middle of the pod. The grub, on hatching, feeds on the seed, devouring three or four seeds before it is full-fed, when it emerges from the pod and drops to the ground in which it pupates. It is a local pest, which may at times do considerable damage, and is said to occur more commonly on areas of black cotton soil.

YOTHERS (W. W.). **Spraying Scheme for the Control of Insect Pests on Citrus Trees in Florida.**—*Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 161–164.

The greater portion of the damage caused by insects to citrus trees in Florida is due to the following species:—*Aleurodes citri*, the citrus whitefly, *Lepidosaphes beckii*, the purple scale, *Eriophyes oleivorus*, the rust mite, *Chrysomphalus aonidum*, *Aleurodes nubifera*, and *Tetranychus sexmaculatus*, the red spider. Pests of secondary importance are *Aleurodes howardii*, the woolly whitefly, and *Tetranychus mytilaspidis*, the purple mite. The pests should be killed before they have done much harm to fruit or tree, i.e., in the young stage. The following sprays have as a rule given satisfactory results. Paraffin-oil emulsion (1 per cent. of oil) kills whitefly, scale-insects, and to some extent rust mites. Spraying should be performed after the adults of the first brood of whiteflies have disappeared and before the appearance of the second brood. Lime-sulphur solution, applied in June and July, kills rust mites. A second spraying of paraffin oil emulsions in October, kills whitefly larvae of the last brood. Soda-sulphur 1–50, added to

the above, increases its effectiveness in killing rust mites. A second spraying with lime-sulphur in November or December may be useful. Soda-sulphur solution is made according to the standard formula, 30 lb. sulphur, 20 lb. caustic soda, 20 U.S. gals. [16·65 Impl.] water; it has the advantage that it will mix with oil emulsions. This scheme, if strictly adhered to, would increase the quantity and quality of the fruit and make the crop more certain from year to year.

PARROTT (P. J.). **An analysis of Spraying Methods against the Codlin Moth.**—*Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 164–170, 2 tables.

Of late years there has been a marked increase in the planting of apple trees and a growing necessity for more frequent applications of spraying mixtures. Lime-sulphur and lead and nicotine are substances most largely used at present. Injurious insects are responsible for reductions in financial returns; failure to maintain a high level of spraying methods may neutralise any benefit derived from pruning, thinning, etc. A study of orchards, under State control, suggests that the problem is in reality a matter of time rather than cost. The purchase and testing of a high-pressure outfit was effected as a possible means of developing economy. It was thought that more effective work could be done against fruit-puncturing Capsids, pear thrips, apple aphids and codling moth by using a great volume of spray under high pressure. The spraying machine was capable of maintaining a pressure of 300 lb. and discharging a flow of 15 gals. per minute. In the experiments against the codling moth only a small percentage of young apples showed penetration of the liquid to the lower calyx cavity. Low pressure spraying seemed most effective, but the data are only based on preliminary experiments. In the West, high pressure sprays have produced apples practically free from injury, while with low pressure great losses have been sustained. This difference in results in East and West is due to a difference in the arrangements of the floral parts. In the discussion which followed the paper, Mr. W. M. Scott stated that high-pressure spraying had, in his opinion, resulted in injury to fruit and foliage by an excess of spraying material and mechanical injury by the pressure. Mr. E. G. Titus supported the remarks of the previous speaker, stating that, in Utah, a hundred-pounds pressure had been found effective.

SHELFORD (V. E.). **Suggestions as to the original Habitat and Distribution of various native Insect Pests.**—*Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 171–174, 1 fig., 1 plate.

A study of the habits of insects throws much light on their original habitat. Insects frequenting garden and forage crops fall into two classes, (*a*) those frequenting low moist situations, and (*b*) those preferring higher ground. Insects of the first class occur along the margins of ponds lakes and rivers and on vegetation growing in water. A comparison of recent works on insect pests with a list of species taken by the author from the margin of ponds, etc., shows that one-third of the species are given in two or more cases. In the second class, the conditions are the same as those for crop pests; the vegetation

of the dry slopes supports Aphids, locusts and beetles of great economic importance. The thickets which bound these dry situations support the majority of native pests of fruit trees and shrubs.

The distribution of species inhabiting moist vegetation is represented by the greater part of the United States and Southern Canada. The species occupying higher and drier ground were not distributed essentially in a different way from the above. The native pests of fruit-bearing trees and shrubs were confined to the deciduous forest area and the moist prairie area. The original centre of distribution and abundance of native pests may be considered as lying within the prairie area. With the clearing of land, the habitats of the pests were expanded to cover the agricultural lands.

HERRICK (G. W.). **Additional Data concerning the Control of the Fruit-Tree Leaf-Roller in New York.**—*Jl. Econ. Entom., Concord,* vii, no. 2, April 1915, pp. 180–186.

During the past three years, *Archips argyrospila*, the fruit-tree leaf-roller, has been abundant in New York State. A series of experiments, conducted in 1912, in an attempt to control this pest, had discouraging results ; on account of the long period of egg-hatching, it seemed impossible to poison the larvae before they became hidden. In 1913, miscible oil sprays were used in a badly infested orchard. The oils were first applied on 2nd and 3rd April. On 13th May, it was found that 76 per cent. of the eggs had been destroyed, while the trees suffered no apparent injury from the oil. In 1914, a more extensive series of experiments was carried out. Three brands of miscible oils were used, and an average of 90·4 per cent. of eggs was destroyed. The oil-spray was supplemented by three applications of lead arsenate at the time when the leaves and blossoms were unfolding. In the discussion following the paper, Mr. W. Yothers stated that in Florida injury by miscible oils could be attributed to the presence of chemicals contained in the oil. In Colorado, arsenical sprays alone had been found quite useless, but miscible oils gave excellent results.

CORY (E. N.). **Preliminary Report on the Woolly Aphis.**—*Jl. Econ. Entom., Concord,* vii, no. 2, April 1915, pp. 186–190.

Experiments on the control of the woolly aphis (*Eriosoma lanigerum*) were begun in 1908 and have followed two main lines, viz., treatment of the soil with dust applications and spraying the tops and soil about the roots. This paper deals only with the results obtained in orchard work. Of all the insecticides used, electro pine tar creosote showed the greatest power of killing aphids, had a strong repellant action and retained its penetrating odour in the soil. Further, it had a stimulating effect on diseased tissues and emulsified readily. A symbiotic relation exists between the aphids and *Lasius* (*Acanthomyops*) *interjectus* ; the latter has a congregating habit, of which it may be possible to take advantage in controlling the ant. Creosote acted as a repellent for the ant. Paradise stocks showed some degree of immunity to attack by the root forms of the woolly aphis.

Haseman (L.). Cotton Worm.—*Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 192–193.

For the past three years the cotton worm (*Alabama argillacea*) has migrated northward across Missouri and during the autumn of 1911 caused serious injury to late varieties of peaches. The moth is able to break through the skin of peaches, apples, etc., in order to feed on the soft inner tissue. Feeding takes place at sundown. During their migration northward, the moths oviposited on cotton; the larvae produced, attacked the cotton foliage, causing severe injury, especially at Columbia. In this latitude winter conditions destroy the pest completely. During the summer two parasites, an Ichneumonid ovipositing in the pupa and a Tachinid fly parasitic in the larva, assist in its control. The boll worm (*Chloridea obsoleta*) was also found to attack the cotton worm in a few cases.

Scott (W. M.). Arsenate of Lime or Calcium Arsenate. *Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 194–199.

During the past two years the author has conducted a series of experiments to determine the value of arsenate of lime as a substitute for lead arsenate. In the experiments recorded, tricalcium arsenate paste was prepared to contain the same percentage of arsenic oxide as is found in standard arsenate of lead, i.e., from 15–16 per cent. The degree of dilution for both materials was 2 lb. to 50 U.S. gals. water, which thus gave the same arsenic content in both diluted sprays. In 1913–1914, apple trees were sprayed with arsenate of lime and lead arsenate. Lime-sulphur was used with both arsenicals to act as a fungicide. Fruit from the sprayed trees was reasonably free from codling moth and no difference could be noted in the efficiency of the two poisons. Calcium arsenate was tested also in New England for the control of shade-tree insects. The results showed that its value was quite equal to that of lead arsenate and there was no injury to the foliage. It has the further advantage of being much cheaper than the lead compound. In the discussion following the paper, Mr. E. H. Siegler stated that during 1914 he had tested a commercial arsenate of calcium containing 18 per cent. of arsenic oxide. This was used at the rate of 2 lb. to 50 gals. lime-sulphur solution; three applications were made. The sprayed trees gave over 98 per cent. of fruit free from codling moth, while the foliage of those sprayed with calcium arsenate was in better condition than those sprayed with lead arsenate. The compound, containing 20 per cent. arsenic oxide, has been prepared at a cost of 1½*d.* per pound. Care must be taken in the preparation to remove all sodium hydroxide, which is formed as a bye-product. In Mr. Scott's experiments, soluble arsenic up to one-half per cent. was present. This was uniformly lower than the amount in lead arsenate.

Safro (V. I.). The Nicotine Sulphate–Bordeaux Combination.—*Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 199–203.

A series of investigations show that it is possible to combine nicotine sulphate with Bordeaux mixture in spraying. The 4–4–50 formula was used in making up the Bordeaux mixture; a commercial preparation of nicotine sulphate, containing 40 per cent. nicotine, was used

at dilutions of 1 to 800–1000. Free copper sulphate, which causes injury to fruit and foliage, was absent from the mixture. The foliage of apple, pear, peach, etc., showed no sign of injury when examined, although the weather variations were sufficient for leaf injury to become evident within the three weeks during which the plants were under investigation. The combination was analysed for nicotine two hours after making; the whole of the latter was recovered. Instances of damage to foliage can be explained by the fact that the combination will probably not prevent any injury that the Bordeaux mixture would cause if used alone. Numerous reports of the successful use of the combination have been received.

PARROTT (P. J.) & SCHOENE (W. J.). **The Insecticidal Properties of various Sulphides and Polysulphides** (*Abstract*).—*Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 204–205.

Sulphides and polysulphides of sodium, potassium, calcium and barium have been used for the last few years as spraying mixtures. Except calcium, they can be obtained in a powdered state; calcium sulphides are obtainable in liquid preparations. The amount of sulphur in these insecticides varies greatly; for example, in sodium preparations it ranges from 1·79 to 58·92 per cent. Experiments have been conducted in which the compounds have been tested on the basis of their sulphur content, the sulphides and polysulphides of the different bases being used at varying strengths to give similar ratios of sulphur respectively in the dilute mixtures. In experiments against the San José scale, using the compounds at the rate of $4\frac{3}{4}$ oz. sulphur to a gallon, there were variations in effectiveness on individual trees. As gauged by the blemishing of fruits, the production of young scales and the infestation of new wood, one preparation had no perceptible advantage over another. The work in general so far points to the conclusion that the strength of a preparation with regard to its sulphur content is a more important consideration than the nature of the base of the sulphides and polysulphides. Assuming that the bases act equally against the scale, the chief factors are the absence of injury to foliage, when combined with lead arsenate, and economy, in which respects calcium and barium sprays are most advantageous. None of the compounds alone were harmful to leaf-eating caterpillars or beetles; when mixed with lead arsenate, the compounds of sodium and potassium showed more rapid toxic effects, but were liable to cause injury to the foliage. Various substances, *e.g.*, glue, soap, glycerine, oil emulsions, can be combined with spraying mixtures to give penetrating and adhesive properties. With the compounds under discussion, no marked results have been observed, except where soap and oil emulsions were used with sodium and potassium sulphides against aphids, or oil emulsion with the same sulphides against the San José scale (*Aspidiotus perniciosus*). The principal gain in the latter case appears to be in an increased rate of toxicity.

SCOTT (W. M.). **A New Contact Insecticide.**—*Jl. Econ. Entom., Concord*, viii, no. 2, April 1915, pp. 206–211.

Lime-sulphur, though unquestionably the most important and the most largely used contact insecticide and fungicide, is bulky and heavy

to transport and difficult to store without loss. Attempts to prepare it in the dry state have failed, as might have been expected, owing to the calcium polysulphides decomposing on drying. Calcium thiosulphate, one of the ingredients of lime-sulphur, is not an efficient insecticide, though soluble in water. Some other base is required, as a sulphur carrier and it has been shown by Parrott and others, that barium polysulphides are equally effective with those of calcium, at least in the control of San José scale (*Aspidiotus perniciosus*), and it is an important practical fact that one of the barium polysulphides can be produced in the form of soluble crystals, while those of calcium cannot, and by boiling barium sulphide (BaS) in water with excess of sulphur, a large quantity of the pentasulphide (BaS_5) is produced, which, on drying, becomes converted into the tetrasulphide (BaS_4H_2O) and free sulphur. This compound is readily soluble in cold water and tables are given showing that the solution at various strengths of from 10 lb. to 32 lb. in 50 U.S. gals. water was equally effective with lime-sulphur, with this further advantage that 32 lb. of the dry barium product contains as much sulphur as 59 lb. ($5\frac{1}{2}$ U.S. gals.) of the lime-sulphur solution, and yet 16 lb. of the former in 50 U.S. gals. water is sufficient to control the San José scale; similar results were obtained with the oyster-shell scale (*Lepidosaphes ulmi*). Experiments on peach trees showed that *Cladosporium carpophilum* was also completely controlled without injury to fruit or foliage. The cost in the U.S.A. is estimated at a trifle more than that of lime-sulphur, but this is more than made up by difference in freight.

McColloch (J. W.). **Recent Results in the Use of Dust Sprays for Controlling the Corn-Ear Worm.**—*Jl. Econ. Entom.*, *Concord*, vii, no. 2, April 1915, pp. 211–214, 1 table.

A study of the life-history of *Chloridea* (*Heliothis*) *obsoleta*, F., the corn-ear worm, shows that complete control of the pest is impossible. The larvae feed almost entirely within the curl of the maize plant or within the ear, where they are out of reach of parasitic enemies or sprays. They are able to develop on a great variety of plants; the adults can migrate readily from one field to another and the female deposits from 500 to 2,000 eggs, the latter being laid singly and only one on a plant. The method of spraying as a control measure has been investigated. It was found that a large percentage of eggs deposited during the summer were placed on fresh maize silks and that the caterpillars arising from these caused injury to the ear. It thus seemed possible to control a large percentage of larvae by keeping the silks well sprayed. Powdered lead arsenate was found to be the most efficient poison. During the summer of 1914, the effect of dusting with dry lead arsenate was determined. Using 100 per cent. lead arsenate, 63 per cent. of the ears were injured; with a mixture of 50 per cent. arsenate and 50 per cent. sulphur, the number of injured ears amounted to 88 per cent. Although in the first case over 60 per cent. of the ears were injured, in almost every case only 1 or 2 grains on each ear were damaged and fungi were absent. A 63 per cent. mixture gave results which were almost as good, at a much lower cost. Hydrated lime would serve as a carrier instead of sulphur, and

in the opinion of the author, the period between the applications could be lengthened to 5 days. This treatment is profitable where maize is grown for roasting ears, show purposes or seed.

HASEMAN (L.). **The Corn-Ear Worm.**—*Jl. Econ. Entom., Concord,* vii, no. 2, pp. 214–218, 2 plates.

The corn-ear worm [*Chloridea obsoleta*, F.] feeds on maize, cotton, beans, peas, etc. The number of broods a year in Missouri has not yet been determined. Eggs are deposited on the maize silks, and oviposition occupies several days. The larvae, which hatch in about 3 days, feed at first on the silks, then pass down to the grains. Other eggs are deposited later on the tips of the ears. The average length of the larval period is $18\frac{1}{2}$ days. Pupation occurs in the soil at a depth of from 1–3 inches. The adult emerges after 7–18 days, is very active and feeds on the juices of flowers and fruit. The length of the life of the adult is probably about 5 days. The actual damage caused by the worm is increased by fungus growths which invariably follow. A discussion on the use of lead arsenate, hydrate of lime and sulphur as dusting powders followed the paper.

DEAN (G. A.). **Further Data on Poisoned Bran Mash flavoured with Fruit Juice as a Means of controlling some Insects.**—*Jl. Econ. Entom., Concord,* vii, no. 2, April 1915, pp. 219–227.

The use of poisoned bait in the control of grasshoppers, army worms, variegated cutworms, etc., has had very successful results. During 1914, several severe local infestations of grasshoppers were reported. Lucerne and wheat crops were saved from injury by scattering the bran mash along the edge of the field into which the insects were moving. Very serious outbreaks of *Cirphis* (*Leucania*) *unipuncta*, the army worm, and *Lycophotia margaritosa* (*Peridroma saucia*), the variegated cutworm, were controlled in a similar way. *Gryllus pennsylvanicus* was very abundant in Kansas during the summer of 1914. A poisoned mash consisting of 1 lb. bran, 1 oz. Paris green, 3 oz. syrup, juice of orange or lemon, and $1\frac{1}{2}$ pts. water, proved very effective. The bait distributed in the evening. In the discussion which followed the paper, the author stated that the insects preferred the bait to the crop they attacked. There had been no report of injury to birds or bees. Those cases among birds in which death had occurred, were due to eating too many grasshoppers. Mr. Regan stated that, in Massachusetts, barriers had successfully retarded the migration of the army worm, the barriers being ploughed furrows dusted with slaked lime, poisoned bran mash and road oil. In New Jersey, the use of shallow ditches was more effective than poison bait in protecting lawns; gasoline was used to destroy the worms collected in the ditches.

FELT (E. P.). **Grasshopper Control in New York State.**—*Jl. Econ. Entom., Concord,* vii, no. 2, April 1915, pp. 227–230.

The following species of grasshoppers were abundant in New York State during May and June of 1914:—*Melanoplus atlantis*, *M. femoratus*, *Camnula pellucida* and *Dissosteira carolina*. The outbreak was

mainly confined to sandy, wild or semi-wild areas, though, in some cases, fields of grain were invaded. A demonstration of the use of Kansas bait was given by the entomologist in a badly infested oat-field. The bait was distributed thinly over a wide area and observations showed that many grasshoppers began to feed on it within 3 to 5 minutes. At the end of 10 days the destruction approached 99 per cent. The cost of materials was estimated at $6\frac{1}{2}d$. per acre. Criddle mixture was used by some farmers with almost equally good results. The sweetened bran is attractive to domestic animals; they should be prevented from gaining access to containers used for mixing the material. An almost complete immunity from grasshopper injury should follow one application.

NEWELL (W.). **Notes on the Insect Enemies of Sudan Grass.**—*Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 230–234.

Andropogon sorghum, Sudan grass, which has become an important forage crop in Texas, is attacked by insects which are well known on other crops. *Contarinia* (*Diplosis*) *sorghicola*, the sorghum midge, renders seed production impossible in heavily infested sections. The midge is essentially an insect found in localities with a heavy annual rainfall. The greater the rainfall during spring and early summer, the greater is the damage done. The only remedial measures are clean harvesting, the complete destruction of Johnson grass, a favourite host plant of the midge, and the fumigation of seed to kill hibernating larvae. *Pentatoma ligata*, attacking all members of the sorghum family, will doubtless prove a serious obstacle to the cultivation of Sudan grass in semi-arid regions. The method of hibernation in piles of wood, etc., suggests, as a remedial measure, the early deep ploughing of infested fields. The destruction of mesquite trees in the vicinity of infested fields is recommended. *Sitotroga cerealella*, the Angoumois grain moth, attacks the seeds of Sudan grass both in the field and in storage. Fumigation with carbon bisulphide destroys large numbers and at the same time does not hinder the germination of the seeds. This crop is also subject to attack by grasshoppers, army worms, etc.

HUNTER (S. J.). **Some Economic Results of the Year.** *Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 234–238.

The effect of intermittent seasonal spraying was tested in an orchard which had been successfully sprayed for three preceding years. During this time the orchard had shown less than 5 per cent. injury by insects and fungi. In 1914, spraying was not performed, and during July–September counts were made of the fruit dropped and the cause of the fall ascertained. The results showed that 1·5 per cent. of the apples were marketable; the remaining 98·5 per cent. had been checked in their growth, the chief source of injury being the codling moth (*Cydia pomonella*). Annual spraying is thus essential for the production of a good crop.

METCALF (C. L.). **A Mechanical Measure for Controlling the Flea-Beetle** (*Epitrix fuscula*) **on Potato.**—*Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 240–241, 3 figs.

In devising a trap for flea-beetles, the author has taken advantage of the jumping habit of the insect. In 1913, a trap was made from a box by cutting out one end, part of the bottom and part of the other end. The inside was covered with tree-tanglefoot; the box was carried along the rows by upright handles, so that the plants passed through the box from one end to the other. By this means from 10,000 to 15,000 beetles per acre were captured. An improvement on this trap was made by placing wires across the inside to prevent the leaves from touching the tanglefoot, and by the addition of a pair of wheels. The trap should precede the operator, so that there is no disturbance of the plants until they have been reached with the trap. The tanglefoot must be renewed after about an acre has been covered.

ALDRICH (J. M.). **The Economic Relations of the Sarcophagidae.**—*Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 242–247.

The idea that the SARCOPHAGIDAE are "flesh-flies" is true for the typical European species, *S. carnaria*; in America, however, although *S. assidua* and *S. sarraceniae* have been bred from dead fish and *S. assidua*, *S. cooleyi*, *S. incerta*, etc., are known to breed on the excrement of mammals, the majority are parasitic on other Arthropods. Two species are recorded from scorpions in Java and Sumatra. Egg-sacs of spiders are attacked by *S. davidsonii*. The adult of the Sialid, *Corydalis cornuta*, has been attacked by *S. helicis*; the latter, as well as *S. hunteri*, *S. sarraceniae* and *S. kellyi*, have been bred from grasshoppers. Larvae have been found attached to the thorax of the adult grasshopper or to the quiescent, newly-moulted forms. In Colorado, *S. erythrura* is important in controlling grasshopper pests. That Sarcophagid larvae invade living lepidopterous larvae has been shown in the case of the army worm (*Cirphis unipuncta*). *Sarcophaga* spp. have been bred from beetles, viz. *Lachnosterna arcuata*, *Dinapate wrightii*, *Calosoma* sp. and *Eleodes* sp. An undescribed species has been obtained from the Longicorn, *Plectrodera scalator*, the cottonwood borer. Human beings are occasionally infected; one case of intestinal myiasis due to *Ravinia trivialis*, normally an excrement-feeding form, has been recorded. A few species only have shown a wide range of adaptation in their larval habits. *S. helicis* has been bred from a snail, *Corydalis*, *Cicada*, several Lepidopterous larvae and adult beetles. Mr. Parker stated that he had captured the following species from excreta: *Ravinia communis*, *R. peniculata*, *S. haemorrhoidalis* and *S. cooleyi*. *Muscina stabulans* had been bred from excreta placed in the open.

McCOLLOCH (J. W.) & YUASA (H.). **Further Data on the Life-Economy of the Chinch Bug Egg-Parasite.**—*Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 248–261, 3 figs., 4 tables.

Eumicrosoma benefica is an important factor in the control of the chinch bug (*Blissus leucopterus*). During 1913, climatic conditions

were favourable for the development of the bug, but the numbers were much below the average. The average parasitism at Manhattan during the summer was 32 per cent. and during the spring, when chinch bugs were most numerous, ranged from 20 to 40 per cent. The period of oviposition of the bug covered about two months, while the life-cycle of the parasite extended over a period of 2–3 weeks. Thus, the eggs of a single bug were exposed to about three broods of parasites. A description of the external characters of the egg, larva, pupa and adult is given. The larva reaches its full development in about six days; by the end of this time the egg of the host is completely destroyed. The pupal stage lasts from 11 to 13 days. The number of eggs laid by the adult females varies between 20 and 40 each. The female cannot distinguish between parasitised and non-parasitised eggs and double parasitism often results. If this occurs, it results in the death of both larvae. If the second parasitism takes place while the first parasite is in the pupal stage, the second parasite does not develop. *E. benefica* can reproduce partheno-genetically, but sexual reproduction seems to be the rule. The parasites show a preference for chinch bug eggs which are from 1 to 3 days old. The length of adult life varies from a few hours to 78 days; low temperatures have the effect of increasing the duration of the adult stage. The period of activity lasts from the beginning of May to the end of November. Nine generations have been raised in a year. The effect of feeding is not appreciable in the length of life or oviposition. The adults show negative phototropism, and in the field are often found between the leaf-sheath and stalk of plants or in small cracks in the ground.

McConnell (W.R.). **A unique Type of Insect Injury.**—*Jl. Econ. Entom., Concord.* vii, no. 2, April 1915, pp. 261–267.

Cerotoma trifurcata, the bean-leaf beetle, is chiefly known from the damage done by the adults to the foliage of beans and cowpeas; the larvae have been described as feeding on the roots and bark of the subterranean part of the stem. In 1912, the nodules of the roots of cowpeas were found to be damaged by larvae resembling those of *Diabrotica*. These proved on examination to be those of *C. trifurcata*; they were most destructive on poor soils where soil enrichment through the growth of a leguminous crop was important. The food-plants of the beetle comprise bush and pole beans, cowpeas, bush clover, *Meibomia* sp., *Faba* sp., etc. The insect is distributed over the eastern part of the country from New York to Minnesota and southward to Kansas and Mexico. The life-history is as follows. The adults emerge from their hibernating places in the spring; after feeding for a week or more on garden beans or native food-plants, they deposit eggs in the soil within a few inches of the base of the plants. Oviposition continues for several weeks. The eggs hatch in about 18 days in spring. The larvae feed on roots, root hairs and nodules. The entire contents of the latter are devoured. Pupation takes place in the soil near the base of the plants at a depth varying from 1 to 3 inches. The larval period varies from 3 to 6 weeks, while the pupal stage lasts about 4 days in summer and 1 to 2 months in autumn. The first generation appears

in June, the second at the end of July and the third in August-November. There is probably a partial fourth brood. Climatic conditions seem to be the principal natural check on the insect. A cold, rainy winter results in high mortality. A few adults are killed by a fungus, probably *Sporotrichum*, and a small red mite. The only internal parasite yet known is the Tachinid, *Celatoria diabroticae*. A determination of the loss in nitrogen-fixation from the attacks of the larvae involves a knowledge of the nodule-forming bacteria and a chemical analysis of the plants. It has been calculated that the legume nodule adds 166 lb. of nitrogen per acre to the soil. The possibilities of successful control of this insect are limited mainly to preventive measures. Thorough spraying with arsenicals in early spring would reduce the number of adults. Wild host plants should be destroyed. Cowpeas should be planted at the end of May or in June to avoid the first generation of beetles. The iron cowpea is damaged much less than other varieties and is also resistant to root-knot disease.

FELT (E. P.). **A New Pest, the Chrysanthemum Midge** (*Rhopalomyia hypogaea*, **H. Lw.**).—*Jl. Econ. Entom., Concord.* vii., no. 2, April 1915, p. 267.

Specimens of chrysanthemum plants badly infested with the Cecidomyid, *Misospatha* (*Rhopalomyia*) *hypogaea*, have been received from Michigan Certain varieties appear to be very susceptible to injury. In the plants examined, swollen masses of infested tissue occurred in and near the midribs of the developing leaves. The species is a European one, recorded as infesting *Chrysanthemum leucanthemum*, *C. corymbosum*, *C. atratum* and *C. japonicum*, producing galls on the stalks, leaves, buds and probably also on subterranean roots. The insect breeds continuously when conditions are favourable, the initial attack being usually confined to buds. The midges transform in the gall ; hibernation occurs in the adult or larval stage within the subterranean buds. The insect has become established in America without its full complement of parasites, and will probably become a serious local pest. Badly infested plants should be burned ; removal and destruction of infested parts of others may lead to the extermination of the pest. Fumigation with hydrocyanic acid, while deadly to midges on the wing, has little or no effect on the larvae.

SASSCER (E. R.). **Important Insect Pests collected on Imported Nursery Stock in 1914.**—*Jl. Econ. Entom., Concord.* vii, no. 2, April 1915, pp. 268–270.

During 1914, nests of *Euproctis chrysorrhœa*, the brown-tail moth, were collected from French nursery stock, and three egg-masses of *Lymantria* (*Porthetria*) *dispar*, the gipsy moth, on cedar and camellia from Japan, and a single egg-mass on azalea from Belgium. Larvae of *Gelechia gossypiella*, the pink boll worm, were found on shipments of Indian cotton. A single living adult of *Dacus oleae*, the olive fruit fly, was discovered on olive seed from Cape Town. This species in Italy requires from 47 to 49 days for the pupa to transform into the adult ; it would therefore be possible for this pest to reach the olive-growing sections of California prior to the emergence of the adult.

Avocado seeds from Guatemala were infested with the larvae of *Conotrachelus* sp. and with *Carpophilus latinasus*. A single specimen of *Cosmopolites* (*Sphenophorus*) *sordidus*, the banana root-borer, was received on a banana plant from Brazil. Egg-masses of *Orgyia* (*Notolophus*) *antiqua*, the tussock moth, have been taken on various plants from Denmark, Holland, France and Belgium. Cocoons of the Limacodid, *Cnidocampa flavescens*, were found on Japanese stock. The citrus leaf-miner, *Phyllocnistis citrella*, has been detected on *Citrus* and *Atalantia* from the Philippine Islands; this species is especially injurious to nursery stock in India. Puparia of *Toxotrypana curvicauda*, the papaya fruit fly, were received in a package containing an unknown plant from Mexico. The following Coccids have been reported frequently:—*Aspidiotus destructor*, Sign., on *Mangifera verticillata*, *M. indica* and *Eugenia* sp. from the Philippine Islands and on coconut from American Samoa. *Chionaspis wistariae*, Cooley, on wistaria from Japan. *Epidiaspis pyricola*, Del Guer., on pear seedlings from France. *Morganella maskelli*, Ckll., on citrus from Java and Brazil. *Chrysomphalus* (*Targionia*) *biformis*, Ckll., on orchids from Venezuela and Colombia. *Odonaspis secreta*, Ckll., on bamboo from Japan. *Odonaspis* sp. on grass from Brazil. *Parlatoria* sp. on mango and citrus from Brazil. *Selenaspidus* (*Pseudaonidia*) *articulatus*, Morg., on limoncillo from Ecuador and on cinnamon from Colombia. *Pseudaonidia duplex*, Ckll., on camellia, persimmon and tea trees from Japan. *Pseudaonidia trilobitiformis*, Green, on *Jaboticaba murta* from Brazil and on citrus from Japan. *Pseudococcus ryani* Coq., on *Sciadopitys verticillata* from Japan. *Pseudococcus calceolariae*, Mask., on sugar-cane from Brazil and on flax from New Zealand.

HEADLEE (T. J.). **The Essentials of Insect Control.**—*Jl. Econ. Entom., Concord*, vii. no. 2, April 1915, pp. 271–276.

This subject is treated from the standpoint of the official concerned with insect control, and deals with the routine work of preventing foreign insect pests from becoming established within the official's territory, as well as of preventing insects already established from assuming the character of serious pests. In order to prevent undesirable insects from becoming established, it is necessary to close the channels through which they naturally enter. In the author's opinion, the most efficient protection of any territory will not come through increasing the complexity of certification, but rather through co-operation of officials, which will give the information sought. As the protection of the territory depends upon the more or less complete examination of stock coming into it, a very valuable factor is advance information of the source, nature, extent, destination, probable date of arrival, and consignee of each of the various shipments. The prevention of the establishment of new pests is far more effective than is the control of outbreaks of insects already established.

BOURNE (A. I.). **Notes on the Onion Maggot in 1914.**—*Jl. Econ. Entom., Concord*, vii. no. 2, April 1915, pp. 276–279.

During 1914, infestation by the onion maggot [*Hylemyia antiqua*] was very slight in comparison with former years. This may have been

the direct result of the severe cold of the preceding winter. Previous work had shown that remedies and methods usually recommended for the control of the onion fly were of no use in large fields, both because of the initial cost and the great expense of labour necessary to apply them. Naphthalene, soluble sulphur, powdered tansy, etc., had had the effect of preventing germination to a large extent. In 1914, naphthalene was diluted with a substance less powerful as a repellent; the retarding effect on germination was not observed and the scarcity of maggots in the experimental plots was very pronounced. The mixture was at first applied by hand to the rows of onion seeds; later, a special planting machine was adapted to carry out both operations at once.

GLENN (P. A.). **The Apple Flea-Weevil in Illinois.**—*Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 279–286.

Orchestes canus, the apple flea-weevil, has been recorded from several localities in Illinois. Injury is caused by both larvae and adults, both stages feeding on the leaves. The reduction of leaf surface by the adult may reach 50 per cent. There is one generation annually. The adult hibernates among leaves or grass or in the soil; activity is resumed in March. As soon as the leaves appear, eggs are deposited in the large veins of the under surface. Egg-laying continues for about a month. The larva hatches in 4–5 days and mines through the leaf towards the tip. Pupation takes place within the leaf after about 3 weeks, and the adult emerges a few days later. The mines develop a conspicuous red colour. The adults feed until late in June and then descend to hibernate. Control measures tested during 1913 included sticky bands, arsenical and contact sprays. It was estimated that bands from 3 to 5 inches wide placed round the trunks of trees reduced the number of larval mines by about 50 per cent. Beetles which emerged late in spring were active and flew directly from the ground to the branches. Sprays could only be applied against the adult stage, as the larvae are leaf-miners. Arsenical compounds sprayed on to the under surface of the leaf had little effect on the adult. It was found that the beetles would not feed on leaves sprayed with lime-sulphur or Bordeaux mixture. During 1914, a lead arsenate and water spray was found to give satisfactory results; the spray consisted of 4 lb. lead arsenate, 8 lb. flour and 100 gals. water. Spraying should be begun before the trees are in bloom, in order to destroy the beetles before eggs are deposited. Later, spraying should begin in the first week in June to destroy the adults of the new generation. The spray should be applied at a pressure of 200 lb., and should be directed over the entire leaf surface. In early experiments, it was found that the beetles were easily killed with kerosene emulsion and nicotine sprays. Large canvases were spread beneath the trees; the spray was directed against the under sides of the leaves at a pressure of 200 lb., and the beetles, as they fell into the canvas, were killed by the kerosene. A 7 per cent. kerosene emulsion and Black Leaf 40 at the rate of 1 pint to 100 gals. water were used. This method works well when the trees are not large and have no low-growing branches. It gives immediate results, but has the disadvantage of requiring more than one application.

Parker (J. R.). An Outbreak of the Alfalfa Looper (*Autographa gamma californica*, Speyer).—*Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 286–290.

An outbreak of the alfalfa looper (*Phytometra californica*) occurred in Montana during 1914, and was particularly injurious in the central and south central parts. Injury by this insect was also reported from South Dakota, Wyoming, Colorado, British Columbia, etc. The moth was first noticed in Montana in the first week in May, being abundant on currant blossoms. In June, lucerne and sweet clover were found to be heavily infested with the larvae. From the middle of June to the beginning of July the larvae gradually decreased in numbers. From pupae collected on 10th June, moths emerged 15 days later. A second brood of larvae was expected in late July or early August, but so abundant were insect parasites and bacterial diseases that no more larvae were observed during the remainder of the season. *Melilotus alba* was the favourite plant of the larvae; lucerne ranked second. Larvae were also seen feeding on *Lactuca pulchella*, flax, sugar-beet, carrots, onions, *Helianthus*, etc. Grains and grasses were never attacked, even when adjoining heavily infested lucerne fields; gooseberries, raspberries and currants were injured only when the larvae were very abundant and other food was scarce. Experimental control work could be carried out only in a limited way on account of the sudden appearance of the larvae. Paris green at the rate of $1\frac{1}{2}$ lb. in 50 gals. water and lead arsenate at the rate of 4 lb. (paste) in 50 gals. were effective in killing the loopers. A dry ditch proved in some cases an efficient barrier. The best method of preventing migration was to keep a stream of water flowing through the main irrigating ditches. Birds destroyed large numbers of larvae. Insect parasites and disease killed so many that the second brood of larvae was unable to do any damage; two species of *Apanteles* and a bacterial disease were the most effective of these natural enemies.

Quayle (H. J.). The Citricola Scale (*Coccus citricola*, Camp.).—*Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 291–292.

Coccus citricola is now known to occur in widely separated localities in California and primarily attacks citrus trees. It has also been found on pomegranate, nightshade, elm and English walnut where these occur near infested citrus. The fact that the scale is susceptible to fumigation for so short a period, makes it an important economic factor in the citrus industry of California. *C. citricola* deposits eggs which hatch in a day or two; there is but one or a partial second generation annually. In 1911, the young of this species began to appear about the 20th April and continued until August. They settle on the under side of the leaves. In November they migrate to the twigs, where they remain until next spring. The following Chalcid parasites have been reared from this scale:—*Coccophagus lunulatus*, How., *C. lecanii*, Smith, *C. flavoscutellum*, Ashm., and *Aphycus* sp. The scale becomes very resistant to fumigation during September, although no external change can be noted. Fumigation between July and the beginning of September has proved satisfactory.

Yothers (W. W.). **Cotton Seed Oil as a Substitute for Whale Oil Soap.** —*Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 298–299.

The following formula has been adopted for the preparation of cotton-seed oil soap: 2 qts. cotton-seed oil, 6 oz. caustic potash, 1 qt. water. The potash is dissolved in water and heated until boiling; the oil is then added, and the whole boiled and stirred for a few minutes. The product contains 63·7 per cent. of oil, 31·8 of water and about 6 per cent. of potash; it has the same consistency as fish-oil soap.

Sherman, Jr. (F.). **Rearing of Moths and Tachinid Flies from Larvae and Pupae of Army-Worm in North Carolina in 1914.**—*Jl. Econ. Entom., Concord*, pp. 299–302, 1 table.

The rearing of Tachinid flies from *Cirphis* (*Heliophila*) *unipuncta* was begun in July 1914. The parasitised caterpillars were placed in cages containing from 1 to 3 inches of moist earth and fresh grass was supplied. From 534 army worms, showing 1,313 parasites, 18 adult moths and 296 parasitic flies were reared, these representing 220 *Winthemia quadripustulata*, 47 *Phorocera claripennis*, 4 *Goniomyia unifasciata* and 25 unidentified flies. The larvae of *W. quadripustulata* left the dead larval host and went deeper into the soil to pupate. In no case where this fly issued did the host form a pupa. In cases where *G. unifasciata* was reared, the host pupated and the parasite emerged from the pupa. The mortality among the flies was less where there were two or more per host larva than where only one was present. This suggests that where there are only one or two eggs per host the latter may have sufficient vitality to prevent the development of the parasitic larva inside the host. From army-worm pupae, *Architas analis* was reared in addition to the above species. Braconid and Ichneumonid parasites were noted or reared from a very small percentage of army-worms. Several predaceous enemies were noted in the field, but in no case were they numerous enough to be an important factor.

Woodworth (C. W.). **Relative Size in Fumigation.**—*Jl. Econ. Entom., Concord*, vii, no. 2, April 1915, pp. 303–304.

The measurements now always taken in obtaining the size of fumigation tents are the distance over the top and the circumference. Most tables now in use are incorrectly calculated, because equal values have been given to both dimensions. It will be evident at once that the distance over the top is changed with an alteration either in the height or the diameter of the tree, and that therefore it is the more important of the two. The possibility of adding to this dimension, an amount dependent on the difference between the two measurements which will indicate the proportionate size of a tent, gives a new and very convenient and accurate method of estimating a tree for dosage. This the author calls the "relative size" of the tent. If the proportions of a tent remained constant, the distance over could then be taken as the relative size. Since the circumference always equals or exceeds the distance over the top, a tent with these two measurements equal may be taken as a standard. The amount to be added to this to allow

for wider and shorter tents is one-fifth of the difference between the two measurements. Thus a tent 20 by 30 would have a relative size of 22 and should have a dose equal to that of a tent 22 by 22.

The adoption of this plan of relative sizes makes it possible to present a table of dosage in an exceedingly simple form, and to make the adjustments for different degrees of leakage also very easy.

A table is given showing the quantities of potassium cyanide, acid and water to be used according to the size of the tent so calculated, a tent of the relative size, 22, requiring 3 oz. of cyanide.

YOTHERS (W. W.). **The Use of Water under Pressure for the Control of Mealy Bug.**—*Jl. Econ. Entom., Concord,* vii, no. 2, April 1915, pp. 304–305.

A system of spraying with water under high pressure for the control of mealy bugs has been successfully carried out in Florida. A stream of water under about 60 lb. pressure is directed against the places where the fruits touch and where the insects congregate. Three applications are sufficient to control a severe infestation.

WALKER (H. C.). **The Box Leaf Miner.**—*Jl. Econ. Entom., Concord,* vii, no. 2, April 1915, p. 306.

Monarthropalpus buxi appeared in Newport in the spring of 1912. The larval stage is passed inside the box leaf, and lasts from the autumn to the beginning of June. The adult emerges from the leaf, is active for a short time and, after pairing, the female deposits eggs on the upper surface of the leaf. In August, small protuberances on the leaves show the presence of larvae which apparently remain there until the following spring. Fumigation in early spring proved unsuccessful; a spray consisting of 4 lb. of powdered sulphur to 50 gals. water, applied in June, killed the adults without injuring the plants.

FELT (E. P.). **Juniper Plant Bug** (*Chlorochroa uhleri*, **Stal.**).—*Jl. Econ. Entom., Concord.,* vii, no. 2, April 1915, p. 308.

This Pentatomid was very abundant during 1914 in Schenectady County, on sunflower seeds, green maize, peas, tomatoes and currants, the seed or fruit being punctured in each case. Another Pentatomid bug, *Euschistus variolarius*, was present in small numbers on maize and tomatoes.

Larch Shoot Moths.—*Jl. Bd. Agric., London,* xxii, no. 1, April 1915, pp. 50–52, 5 figs.

Argyresthia atmoriella, *A. laevigatella* and *A. zelleriella*, the larch shoot moths, are widely distributed, the first two species occurring in Britain, the last on the Continent. In Britain, the moths appear in May or June and lay their eggs on the young shoots. The larva proceeds to burrow spirally into the wood. In May of the next year, the larva approaches the surface to pupate, and finally the moth emerges. Members of the genus *Larix* only seem to be attacked. The side branches as a rule are injured, and die at the end of their first year.

The moths exist wherever larch is grown, but are only destructive in localities not suited to the tree. The pest is therefore best controlled by restricting the tree to favourable localities. No treatment can be as yet suggested for an extensive attack, but where only a few trees are injured, the dead branches can be removed and burned.

PETHYBRIDGE (G. H.). **Investigations on Potato Diseases.** (Sixth Report).—*Jl. Dept. Agric. and Technical Instruction for Ireland, Dublin,* **xv**, no. 3, April 1915, pp. 491–526, 16 figs.

The most important insect pests of potatoes in Ireland, are the potato flea-beetle, [? *Phyllotreta affinis*, Payk.], the frosted orange moth, *Xanthoecia flavago* (*Gortyna ochracea*), and the rosy rustic moth, *Hydroecia micacea.* The last-named species was observed in 1914; the larvae burrow out the central portion of the potato stalk.

County Horticultural Instructor. Home Correspondence.—*Gardeners' Chron., London,* lvii, no. 1476, 10th April 1915, p. 200.

It has been proved by numerous experiments in the Isle of Wight, where climatic conditions favour both insect and fungus pests and render the buds fairly plump and the bark delicate, that alkali washes are beneficial, provided that their action is modified by the addition of 4 oz. or $\frac{1}{4}$ pint of paraffin jelly to every gallon. The effect of the caustic washes is thus minimised, and bark and buds are uninjured. Annual spraying with weak mixtures is preferable to occasional spraying with stronger ones. Apple trees were successfully treated as late as 25th March and peach and nectarine trees on 15th March, when the buds were showing colour.

EDWARDS (J.). ***Bruchus objectus*, Say, in Britain.**—*Entom. Mthly. Mag., London,* li, no. 4, April 1915, pp. 140–142.

Specimens of *Bruchus objectus* have been found feeding in dwarf bean seeds. This species was received under the name *B. lentis*, Boh., but seems inseparable from the north and central American species, *B. obsloetus*, Say.

WADSWORTH (J. T.). **Note on an Anthomyid Fly, *Phaonia* (*Hyetodesia*) *trimaculata*, Bouché, new to the British List.**—*Entom. Mthly. Mag., London,* li, no. 4, April 1915, pp. 142–143.

While collecting larvae and pupae of *Chortophila brassicae*, the cabbage root fly, the author found a few larvae that were larger than those of *Chortophila*. These pupated and adults emerged in 15–21 days, which were identified as *Phaonia trimaculata*, Bouché. According to this authority, this species is fairly common, and the larvae, which destroy the roots of cabbages, are to be found in summer and autumn, in company with those of *C. brassicae*.

H. A. B. **The Sweet Potato Weevil.** -*Agric. News, Barbados*, xiv, **no. 339, 24th April 1915, p. 138, 1 fig.**

Cylas formicarius (the sweet potato weevil) is distributed throughout the tropical and subtropical parts of the world, having been reported from India, Africa, United States, Jamaica, the Bahamas, etc. The weevil deposits its eggs in the thickest vines near their base, and in the roots, when exposed at the surface. The life-cycle occupies 30 days, several generations being produced during the season. Potatoes should not be planted on the same land for two successive crops; slips for planting should not be taken from fields infested with either this weevil or the scarabee (*Euscepes batatae*).

WARE (Lt.-Col. F. C. W.). **Locusts in Baluchistan.**—*Agric. Jl. of India, Calcutta*, x, 2, April 1915, pp. 159–166, 2 plates, 1 map.

Locusts appear in Baluchistan at intervals of every few years, always arriving after years of good rainfall, and entering the province from the Persian side. Investigations have shown that the swarms start from the Great Kirman Desert. The Baluchistan species, *Schistocerca* (*Acridium*) *peregrina*, closely resembles acris *Cyrtacanthacris septemfasciata* (*A. purpuriferum*), of South Africa, in its habits. Observations in the latter country have shown that the periodic plagues radiate from the Kalahari Desert and that the eggs can retain their vitality for some years, but require moisture and a temperature of 90 to hatch out. In the Chagai District, eggs are invariably deposited in soft, damp soil. It seems probable that, of the parent swarm which leaves the Kirman Desert, some individuals return to lay eggs and to start the cycle afresh. Under suitable conditions, the young locusts hatch in 10–12 days. They feed on the nearest vegetation, undergo several moults, and attain maturity in six weeks. The swarm takes to a flight when a strong wind is blowing in a favourable direction. The appearance of yellow locusts indicate that the flight is about to deposit eggs and it should, if possible, be kept under observation. The collection of eggs may be induced by the offer of a suitable reward. Ploughing exposes the eggs to the sun and so destroy, their vitality. Sodium arsenite mixed with molasses, sprayed on to vegetation in front of a moving swarm has been found invaluable in Africa. Shallow trenches, into which young locusts can be driven and killed, are useful. Bushes, under which the swarm rests at night, can be burned. The disadvantage of mechanical destruction is that it involves the employment of a large body of men, if appreciable results are to be obtained.

FOSTER (S. W.) & JONES (P. R.). **The Life History and Habits of the Pear Thrips in California.** *U.S. Dep^t. Agric., Washington, D.C.* Bull., no. 173, 13th April 1915, 52 pp., 14 figs., 5 plates, 13 tables.

Taeniothrips pyri (the pear thrips) has also been reported from New York State, Pennsylvania, Baltimore and England. Since its discovery in the San Francisco Bay region, in 1904, the insect has rapidly become one of the most important pests of California, and has caused

a very great loss to the fruit industry. The wide range of food-plants, including pear, apple, almond, cherry, dogwood, acacia, etc., makes its extermination practically impossible. Injury to plants is caused directly by the feeding of the adults and larvae upon the fruit, buds, flowers and leaves, and by the deposition of eggs in the leaves, fruit-stems and fruit. The chief injury to pears is caused by the feeding of the adults in the bud-clusters before blooming. A considerable quantity of sap is exuded ; blue moulds may develop in this and so hasten the destruction of the fruit buds. To secure the best results, it is desirable to apply efficient treatment against the adult in order to reduce the early injury to a minimum, and later to carry out additional treatment against the larvae. Injury to prunes ranks second to that of pears, the adult thrips attacking the flower buds in this case also. The larvae may also cause serious damage to the leaves. Cherries are chiefly injured by the deposition of eggs in the fruit stem and by the feeding of the larvae upon the foliage. The manner of bud growth and blossoming of cherries permits the effective penetration of spray solution more advantageously than is the case with either pears or prunes. In the case of peaches, the thrips feed inside the calyx cups and prevent proper pollination. The adult emerges from the ground in late winter and early spring, i.e., during February and March, the exact time being dependant on the temperature, rainfall and the presence or absence of grass in the soil. Individuals which emerge early, feed for 15 to 20 days before oviposition, until suitable tissue is available. Egg-laying lasts for about three weeks. The emergence period is associated with the blossoming periods of the different varieties of fruit. Evidence of the migratory habits of the pear thrips has been noticed. Observations indicate that migration in swarms takes place only on sunny days. The habit is probably influenced by a desire for new food supply, better places for oviposition and suitable weather conditions. Migration from badly infested orchards is influenced by the early destruction of the fruit buds. Many instances are known in which thrips have been very numerous one year, less abundant the next, and again very injurious the third. This re-appearance shows that orchards should not be left untreated. Some adults crawl up the tree after emergence from the soil, but the majority fly to the branches to feed and deposit eggs. The only known type of reproduction is by parthenogenesis. Eggs are placed in exposed blossoms, fruit stems, leaves, and in young fruit. The first eggs were observed in San José on the 9th March, the last in the middle of April. The length of the egg-stage varies from 6 to 30 days, according to the temperature. A single female lays, on an average, 131 eggs, these being placed beneath the epidermis. The larvae appear first on almonds, apricots and plums about the 1st March. The larval stage lasts from 2 to 3 weeks. After being on the tree from 10 to 14 days, the larvae enter the soil to pupate ; the depth varies from 1 to 26 inches, according to the kind of soil. A prepupal stage lasting from 2 to 8 months precedes the formation of the pupa ; the largest number of pupae are found in September and October, but pupation begins earlier in heavy sedimentary soils than in light gravel. The duration of the pupal stage varies from 1 to 4 months. The first adults appear in the ground in late October, the number increasing until early January ; the time passed in the soil by the adults is, on an average,

three months. Of the few natural enemies of *T. pyri*, the most important is the Anthocorid bug, *Triphleps insidiosus*. Others are Chrysopid and Syrphid larvae, the Coccinellids, *Scymnus ater* and *Megilla maculata*, the Staphylinid, *Gyrophaena manca*, and *Anaphothrips striatus*. An *Empusa* fungus has been discovered on a species of thrips in the larval, adult and pupal stages.

BUSCK (A). *Gracilaria azaleae*, **Busck**. = *G. zachrysa*, **Meyrick**.—*Insecutor Inscitiae Menstruus, Washington, D.C.*, iii, nos. 1–4, **January—April 1915, pp. 42–43.**

Gracilaria zachrysa has been recently imported from Asia into Europe and thence into America, having been introduced into the latter country on an imported Azalea. The species was discovered in Holland in 1912 on plants of *A. indica*; serious damage is caused by the larva, which first mines, and then rolls, the leaf. It is possible that this species may reach America directly from Japan and, in time, be considered indigenous, as it is closely related to an American group of the genus. An earlier synonym of this species is *G. azaleella*, Brants, (1913).

KNAB (F.). **Two New Species of** *Pipunculus* **(Diptera: Pipunculidae).**—*Proc. Bio. Soc., Washington*, xxviii, 13th April 1915, pp. 83–86, **1 plate.**

Two new species are described, *Pipunculus industrius* and *P. vagabundus*, reared during investigations conducted by Professor H. H. Severin, from sugar-beet leaf-hoppers parasitised by the larvae.

RAU (P.). **Duration of Pupal and Adult Stages of the Meal Worm,** *Tenebrio obscurus*, **Linn. (Coleop.).**—*Entom. News, Philadelphia*, **xxvi, no. 4, April 1915, pp. 154–157, 4 tables.**

The duration of the pupal stage of *Tenebrio obscurus* is stated to vary from 4 to 24 days, with an average of 15 days; the adult stage varies from 10 to 55 days, with an average of 24 days. The food of both larvae and adults consists of barley, oatmeal, seeds, rice, etc. Eggs are deposited in early summer; in August, the larvae are full-grown, but continue to feed until March, when they pupate.

BRAUN (A. F.). **Life History of** *Menesta albaciliella*, **Chambers (Lep.).**—*Entom. News, Philadelphia*, xxvi, no. 4, April 1915, pp. 160–**161, 1 fig.**

Menesta albiciliella, Chamb., feeds in the larval stages on the leaves of the blackberry. A web of silk is spun on the under-surface of the leaf between the midrib and a lateral vein, beneath which the larva feeds. At maturity, the web is thickened and serves to protect the pupa. Adults appear in July. A second generation, produced late in the summer, gives rise to adults in the following spring.

Parrott (P. J.) & Hodgkiss (H. E.). **The Status of Spraying Practices for the Control of Plant Lice in Apple Orchards.**—*New York Expt. Sta., Geneva, N.Y.*, Bull. no. 402, April 1915, pp. 193–210, 2 figs., 2 plates.

The foliage and fruit of apple trees in New York are subject to attack by *Aphis pomi, A. sorbi* and *A. avenae.* Experiments in recent years indicate that the most effective and satisfactory means of protecting the young fruit is the destruction of the aphids on the expanding buds. The best spraying mixtures are nicotine solution, oil emulsions or soap preparations. The physical features of the locality of the orchard have a marked influence on the development of the buds. The time for effective spraying will therefore vary with individual orchards, as well as with different varieties of apples. The following periods in the life-history are susceptible to attack by spraying mixtures :—The egg-stage, the time of hatching and collecting on the green ends of the opening buds, the time of maturing of the stem-mothers and the first appearance of their young, and the occasion of the appearance of autumn migrants and egg-laying females on apple trees. The eggs of the green aphis are destroyed to some extent by lime-sulphur preparations and oil emulsions. Newly hatched lice are very susceptible to spraying mixtures, while the leaves and flowers are protected from injury in the partly opened buds. Late spraying for stem-mothers and their young often proves unsatisfactory owing to the curled state of the leaves at this period. The destruction of autumn migrants is attended by practical difficulties, but theoretically, should prevent the deposition of eggs for the next year. As a result of experiments carried out in 1913, it was found that a thorough spraying with lime-sulphur and nicotine solution at the time when the buds were showing green at the ends was most effective. Spraying just before flowering had no appreciable effect. Applications made 10 days after blossoming did not give satisfactory results because of the stunted condition of many young apples, the extent of curling of the leaves, and the numbers of aphids which escaped the spray.

Surface (H. A.). **Spray for the Apple Aphis now.**—*Zool. Press Bull., Div. of Zoology, Pennsylvania Dept. Agric., Harrisburg, Pa.*, no. 313, 26th April 1915.

Apple trees should be sprayed during April for *Aphis pomi* and San José scale (*Aspidiotus perniciosus*), with dilute lime-sulphur solution. The spray should be in the proportion of 1 part concentrate to 10 parts water. If spraying is not done until after the leaves have been curled by the aphis, a nicotine solution must be used. For cherry aphis, a solution containing 1 part concentrate to 50 parts of water should be used.

Stewart (V. B.) & Leonard (M. D.). **The Rôle of Sucking Insects in the Dissemination of Fire Blight Bacteria.**—*Phytopathology, Baltimore, Md.*, v, no. 2, April 1915, pp. 117–123.

While all insects which occur on host plants are responsible for carrying the fire blight organism, *Bacillus amylovorus*, from plant to

plant, experiments show that the sucking insects are the most important agents, as they often deposit the bacteria in the punctures they make in the plant tissues. An account is given of experiments to determine the extent to which certain sucking insects act as such agents. Shoots of certain plants were smeared with the agar culture of *B. amylovorus* and specimens of different insects were caged, first over the smeared plant and secondly over a healthy plant, and the extent of the injury conveyed from one plant to the other was observed. These investigations showed that the bugs, *Campylomma verbasci*, H.S., *Orthotylus flavosparsus*, Sahl., *Poeciloscytus basalis*, Reut., and *Adelphocoris rapidus*, Say, all spread the bacteria over young apple seedlings. The first two were specially active disseminators, their attacks being chiefly confined to the tips of the shoots. It is however noted that sucking insects may be present in great numbers without the occurrence of much blight, owing perhaps to the absence of cankers to furnish a source for blight infections and the unfavourable condition of the trees for infection. Thus in 1914, one large nursery was seriously injured by *B. amylovorus*, conveyed from a neighbouring nursery stock; here, there had been abundant rainfall during July and August. In another nursery similarly situated near an infected nursery, but where the rainfall had been light, practically no blight was observed. *Lygus invitus*, Say, is thought to convey the blight on pear trees, and it is suggested that certain species of flies which are attracted to the gummy exudations of blighted trees, also act as disseminators.

TRUE (A. C.). **Report on the Work and Expenditure of the Agricultural Experiment Stations during the year ended 30th June 1913.**—*U.S. Dept. Agric., Washington, D.C.*, 5th February 1915, 109 pp. 6 plates. [Received 9th July 1915.]

In Alabama, additional data regarding the life-history of the rice weevil (*Calandra oryzae*) were secured and practical means of control worked out. In granaries and mills a temperature of 120°-150° destroyed the insects and their eggs without injuring the grain. Experiments conducted with fumigants at the Kentucky Station, indicated that the use of hydrocyanic acid gas, carbon bisulphide and carbon tetrachloride had apparently not affected the germinating powers of the seeds under test. A volumetric method for the analysis of lime-sulphur solutions was devised. In Montana, a complete life-history of *Pemphigus betae*, the sugar-beet root-louse, was worked out and an effective means of control by methods of applying irrigation water was established. The subjects given chief consideration by the Nebraska station were insect parasitism, life history and control of the European elm scale (*Gossyparia spuria*); and by the New Hampshire station, the control of root and apple maggot and black fly, the use of fungicides and insecticides and their effect on plants, and the effect of temperature in the preparation of Bordeaux mixture. Observations on cotton and melon aphis (*Aphis gossypii*) showed that this insect can be controlled by spraying with 1 part Black Leaf 40 in 900 parts of water. The study of the wireworms *Horistonotus uhleri* and *Monocrepidius vespertinus* was continued in South Carolina. These insects oviposit in June and July and the adult requires loose soil for oviposition.

Ball (E. D.). **How to Control the Grasshoppers.**—*Utah Agric. Coll. Expt. Sta., Logan*, Bull. no. 138, February 1915, pp. 79–116, 6 plates. [Received 28th May 1915.]

The migratory grasshopper, *Camnula pellucida*, occurs in the U.S.A. throughout the mountain region of the West and extends across the continent to the north. Serious outbreaks have been reported from Idaho, Wyoming, Montana and Utah. The young hatch in May or the beginning of June; migration takes place in late June and July and oviposition begins in August. Migration is almost always in a south-east or southerly direction and reaches a maximum speed on warm, sunny days. Water will stop migrations entirely. The breeding grounds selected are dry and dusty, usually strongly alkaline. The eggs are laid in the ground in masses of from 19 to 23; each female lays about 40 eggs. The greatest damage in Utah is to pasture land and grain crops. In addition to the generally known control methods, such as destruction of eggs by ploughing, trenching and spraying, a special " balloon " catcher has been devised. This consists of a bag fitted to a frame which is drawn over the field. The eggs are destroyed to a large extent by a parasitic fly and by a predaceous species of *Calosoma*. The non-migratory forms, *Melanoplus femur-rubrum*, *M. atlantis* and *M. vittatus* attack lucerne crops and young orchards. A trap, similar in principle to the " balloon " catcher, has given good results in capturing these species. It consists of a curved sheet of tin, about 2½ feet high, below which is fixed a box about 16 feet long by 2 square feet in section. The apparatus is drawn over the field and the grasshoppers, jumping against the tin surface, slide down into the box below. Young orchards can be adequately protected by the use of poisoned bran mash. The eggs are attacked by the same enemies as those of *C. pellucida*. The larvae and adults are controlled by the larvae of the hair snake, by red mites, and by a fungus disease caused by *Empusa grylli*. *Anabrus simplex* seriously menaces crops in the spring. When the swarms reach low lands, they can be checked by the same methods as are applied to grasshoppers.

Thompson (W. R.). **Sur un Diptère Parasite de la larve d'un Mycethophilide.** [On a Dipterous parasite of the larvae of a Mycetophilid.] —*C. R. Soc. Biol., Paris*, lxxviii, no. 5, 19th March 1915, pp. 87–89, 1 fig.

Parasitism of Diptera by Diptera seems to be rare. Roubaud, in 1906, described the Tachinid, *Bucentes* (*Siphona*) *cristata*, F., as parasitising the larvae of *Tipula maxima*, and according to Bezzi and Stein, *Admontia amica* is also a parasite of a Tipulid. The author records a Dipterous parasite of the larvae of a Mycetophilid of the genus *Sciara*, the conditions differing from those of the cases cited, in that, instead of attaching itself to the tracheal system of the host, this larva inhabits the general body cavity and is therefore dependant for oxygen on such as is dissolved in the plasma. The larva is believed to be either a Dexiid, or more probably a Tachinid.

KEILIN (D.) & THOMPSON (W. R.). **Sur le Cycle evolutif des Dryinidae, Hymenopteres parasites des Hemipteres homopteres.** [On the evolutive cycle of Dryinidae, Hymenoptera parasitising Homoptera.]—*C. R. Soc. Biol., Paris*, lxxviii, no. 5, 19th March 1915, pp. 83–87, 10 figs.

The DRYINIDAE dealt with in this paper are all parasitic on Homoptera, such as Fulgorids, and especially Jassids. The material used for these observations consisted of *Typhlocyba* sp. collected in the Luxembourg gardens in Paris, specimens of *Thamnotettix* from Cambridge, and some Jassids from Ceylon; the detailed description of the young larval stages applies to the larvae found in *Typhlocyba* sp. In the earliest stage, which is said to be strictly embryonic, the parasite is found in the interior of its host, affixed to the inner wall of the first abdominal segments and enveloped in a sort of cyst, through the walls of which all its nutriment must pass. When the larva is developed, it penetrates between the first two abdominal segments, producing an external hernia. This never takes place in *Typhlocyba* until after the second moult. As the growth of the parasite proceeds, the *Typhlocyba* becomes more and more sluggish. Just before the larval parasite detaches itself from the host, it alters its mode of feeding, and devours the whole of the internal organs; it then falls to the ground, pupates and remains in this state until spring. The anatomy of the larva in its various stages is described in detail.

PRATT (H. C.). **The Malayan Locust** (*Pachytylus* sp.)—*Dept. Agric. Fed. Malay States, Kuala Lumpur*, Bull. no. 24, 1915, 42 pp., 3 figs., 16 plates, 1 map.

The locust has probably been imported into Malaya, where the life-cycle occupies from 100–140 days. The breeding grounds are scattered. There is a general periodicity in the abundance of hoppers and adults, but the different stages can often be found in the same district at the same time. The young forms feed mainly on wild grasses, when these are abundant; rice and coconuts are also attacked. Migration begins two or three days after emergence, and it seems probable that the direction followed is not entirely due to climatic conditions. Natural enemies have not so far been of any material use in reducing the number of locusts. A few predatory Hymenoptera are known, mainly attacking the hoppers, such as:—*Vespa cincta*, *Polistes sagittarius*, *Camponotus* sp. and *Oecophylla smaragdina*. Uninterrupted rain has a marked effect on the number of eggs and fliers. In the Malay States, very little success has been achieved by the collection of eggs or their destruction by ploughing or hoeing. The three methods used against the hoppers are the driving and pit system, poisoning and netting. The chief difficulty in the pit method lies in the fact that, in many cases, the swarm is not sufficiently concentrated. Easily portable traps consisting of canvas, have been devised and do away with the necessity of digging ditches. The danger of changing the direction of advance, due to digging a short distance in front of a swarm, is thus avoided. The most effective stomach poison, as shown by a series of spraying experiments, is sodium arsenite. If this is used, measures must be taken to prevent cattle, etc., from feeding

on the poisoned grass. Strong kerosene emulsion forms a suitable contact poison for young hoppers. Netting has proved useless in Malaya, on account of the rough nature of the land. According to Mr. F. de la Mare Norris, the poison method has given the best results in open grass and lalang lands, but has also been valuable in dealing with swarms in the vicinity of jungle. It has been used in rice fields where it is desirable to poison a band on the edge of the field before the locusts have entered it. In Northern Selangor, locusts were exterminated by the bag-trap method. Attempts to destroy flying locusts have failed, except in one case where the swarm had settled to oviposit.

NOWELL (W.). **The Efficiency of Fungoid Parasites of Scale-Insects.**—*Agric. News, Barbados*, xiv, nos. 337–338, 27th March & 10th April 1915, pp. 110 & 126–127.

The fungus control of insects offers an alternative to the use of poisonous sprays, but it depends entirely on the particular circumstances of the case as to which method is more efficient or less troublesome. Fungoid parasites are at a disadvantage, in that they do not become very effective until their hosts are plentiful. The more thoroughly they kill off their hosts, the less material they have to live upon. When the chances of infection have been thus reduced, the surviving insects, or colonists from another area, start a fresh wave of infestation, which in time is again overtaken by the rising numbers of the fungus. Caution should be observed in making use of infested material, lest scale-insects not already present on the plants should be introduced. In one case, recently collected leaves of grape-fruit, on which the scales were well infested with three species of fungi, were found to have numbers of young examples of the mussel scale (*Lepidosaphes*) crawling over them more than a week after they were picked and dried.

URICH (F. W.). **Entomologist's Report.**—*Minutes of the Meeting of the Trinidad Bd. Agric.*, no. 3, 19th March 1915, p. 11; no. 4, 16th April 1915, p. 15.

In connection with the work on cacao beetles, the Siparia and Erin districts, where spraying and cutting out of larvae had been regularly performed, were practically free from larvae. A series of spraying experiments for the beetles was carried out at Maraval. It has been found that thrips from Immortel [*Erythrina*] flowers are not of the same species as those attacking cacao, but have been identified as *Franklinothrips insularis*.

In the Arima and Diego Martin districts, thrips and cacao beetles and their larvae are not numerous. A sweet potato borer, not yet identified, has been observed; the larva forms tunnels into the stem and root of the plant. Rotation of crops and selection of uninfested slips for planting are recommended; when grown on a small scale, the cutting out of affected stems in the early stages would be beneficial.

Weiss (H. B.). **Insect Importations into New Jersey during the Fall of 1914.**—*Canadian Entomologist, London, Ont.*, xlvii, no. 4, April 1915, p. 136.

In the autumn of 1914, the following insects were found on nursery stock imported into New Jersey :—*Diaspis boisduvalii*, on orchids from Belgium and England ; *Pseudococcus* sp., on palms and metrosideros from Belgium ; *Coccus hesperidum* on bay trees and camellias from Belgium and Germany ; *Chrysomphalus dictyospermi* on palms from Belgium, England and Scotland ; *Aspidiotus hederae* on palms, camellias and lapagerias from Belgium, Germany, England ; *Hemichionaspis aspidistrae* on aspidistra from Belgium ; *Chrysomphalus aonidum* on palms from Belgium ; *Lepidosaphes ulmi* on apple and boxwood from England and Holland ; *Chrysomphalus* (*Targionia*) *biformis* on orchids from Central America ; *Isosoma orchidearum* on orchids from Brazil and Central America ; eggs of *Orgyia* (*Notolophus*) *antiqua* on roses from Holland ; *Aleurodes* sp. on azaleas from Belgium, Holland and Germany ; larvae of *Gracilaria zachrysa* (*azaleae*) on azaleas from Belgium ; Tingitid eggs on rhododendrons from Belgium, Holland ; and *Ceuthophilus* sp. in packing around stock from England.

Güssow (H. T.). **The Control of Potato Diseases.**—*Agric. Gaz., Canada, Ottawa*, ii, no. 4, April 1915, pp. 323–325.

Two special applications are recommended in spraying for the Colorado beetle (*Leptinotarsa decemlineata*) ; one, when the plants are from four to six inches high, to be followed by another from one to two weeks later, according to the severity of the attack. The solution contains 8 to 10 oz. of Paris green and $1\frac{1}{2}$ to 2 lb. of lead arsenate to 40 gals. of water. Spraying should generally commence towards the 1st July. After the first two applications, spraying is continued regularly once a fortnight right up to harvest time, the following Bordeaux mixture being used :—Four pounds of lime or more, if necessary ; 6 lb. of copper sulphate, 12 oz. of Paris green, 40 gals. of water. Spraying must always be done very thoroughly and one careful application is better than several carelessly made.

Gibson (A.). **The Control of Cutworms.**—*Agric. Gaz., Canada, Ottawa*, ii, no. 4, April 1915, pp. 330–332, 3 figs.

The poisoned bran remedy is the one which is now used most extensively for the destruction of cutworms generally [see this *Review*, Ser. A, ii, p. 159]. The formula given here is made up as follows :—Two gallons of water, in which half a pound of sugar has been dissolved, are used to moisten fifty pounds of bran. The bran is then dusted with half a pound of Paris green. This mixture is applied thinly at sundown as soon as cutworm injury is noticed and is actually preferred by the larvae to growing vegetation. During 1914, the Kansas grasshopper poison bran formula [see this *Review*, Ser. A, ii, p. 249] was found of equal value to the above in the destruction of the variegated cutworm (*Lycophotia margaritosa*).

French, Junr. (C.). **Insect Pests of the Carnation.**—*Home & Garden Beautiful, Melbourne,* 1st April 1915, pp. 999–1001, 4 figs.

Cutworms are serious pests of carnations, the base of the plant or the buds being destroyed by the larvae. Spraying with lead arsenate or scattering poisoned bait are suitable remedies. Thrips, attacking the flower buds, can be sprayed with benzole emulsion when the buds are beginning to show. Coal-tar spray, consisting of 1 lb. coal-tar in from 50–100 gals. water, nicotine, or hellebore also give good results. Mealy bug injures the roots of carnations. Carbon bisulphide should be injected into the ground at a distance of 3 feet from the plant. The Rutherglen bug (*Nysius vinitor*) is abundant on the flowers in hot weather. It can be removed by spraying with benzole emulsion, 1 lb. in 5 gals. water. The eggs of the light-brown apple-moth are often deposited in the young flower buds, upon which the larvae feed as soon as they are hatched. Lead arsenate or kerosene emulsion sprays give good results. The moths are attracted by light.

Garman (H.) & Jewett (H. H.). **The Life-History and Habits of the Corn-ear Worm** (*Chloridea obsoleta*).—*Kentucky Agric. Expt. Sta., Lexington,* Bull. no. 187, December 1914, pp. 513–591, 16 figs., 3 plates. [Received 10th July 1915.]

The particulars of the life-history of *Chloridea obsoleta* recorded in this paper are the results of observations and experiments begun in 1889 and continued until 1914. The corn-ear worm feeds on both leaves and seed of tobacco pods, on *Abutilon avicennae* and on the fruit and leaves of tomato, but prefers maize to the latter. The moth will eat bait consisting of various sweet substances, and visits flowers in the daytime ; it is not attracted to light. Injury begins on tomatoes and maize in June, and ends on late maize and tobacco suckers, gradually increasing in severity with the advance of the season. The late fourth brood may be greatly reduced by the effects of frost and attacks of enemies. The experiments of 1909 showed that the rate of development of the caterpillar is influenced by temperature and food conditions. The time required for complete development is a month and three or four days. If the insects emerge in the middle of June, as some do, there is opportunity for the production of a brood by the 20th July, another by the 25th August, a third by 30th September, and a fourth by the middle of October, allowing a longer period for the latest brood. The number of broods is liable to be reduced by cold both in spring and autumn. Moths from hibernating pupae may emerge from March to August. The first eggs were found on the 28th June. During 1912, attention was given to the parasites and other enemies of this pest. In 1913, breeding experiments, conducted in the west of Kentucky, showed an acceleration of development on account of the warmer climate, the cycle lasting from 28½ to 30 days. More than nine-tenths of the eggs are deposited on the young silks, on which the larvae feed at first. They then burrow along the cob, destroying the grain as they go. The damaged maize is liable to injure or even kill animals which may be fed on it. Early varieties of maize escape attack almost completely. Injury to cotton was found to be slight, the bolls attacked being those nearest to maize fields

Tomato and tobacco are always attacked, but only severely when growing near maize. Hungarian millet, *Rosa*, *Calamintha*, and *Reseda luteola* can serve as food-plants. Spraying and dusting with lead arsenate during 1914, gave a slight increase in yield for the treated as compared with the untreated maize. Insect enemies of *C. obsoleta* include :—*Trichogramma praetiosum*, parasitic on the egg; the Coccinellids, *Megilla maculata* and *Hippodamia convergens*, and the Antho-id bug, *Triphleps insidiosus*, feeding on the egg; a beetle larva, haps the Telephorid, *Chauliognathus marginatus*, attacking the larvae; the Reduviid, *Nabis* (*Coriscus*) *ferus*, and *Chrysopa oculata*, latory on the caterpillars.

Reed (W. V.). **Some of the more important Truck Crop Pests in Georgia.** *Georgia State Bd. Entom., Atlanta*, Bull. no. 41, March 1915, 39 pp., 29 figs.

Tetranychus bimaculatus is injurious to tomatoes, beans, melons, cucumbers, etc. A mixture of lime and sulphur sprayed on to the upper and under surfaces of the leaves is an efficient remedy. *Murgantia histrionica*, the harlequin cabbage bug, attacks the leaves of cabbage, mustard, radish and turnip. Burning all waste material, during winter, will destroy many hibernating adults. Kerosene emulsion can be used against the immature stages. *Anasa tristis*, the squash bug, hibernates in the adult stage ; the larvae injure plants by sucking the juices and also causing irritation by means of the poison injected. Hand-picking may be resorted to in small areas ; trapping by means of early plants, is also recommended. Spraying with 10 per cent. kerosene emulsion or Black Leaf 40 at the rate of 1 part to 300 parts of water, kills the nymphs. Cotton, cucumbers and melons are attacked by *Aphis gossypii*, which congregates on the under surface of the leaf. Eggs laid in the autumn hatch the following spring. Many generations occur during the summer. This aphis suffers severely from parasitic and predaceous enemies. Black Leaf 40, soap solution at the rate of 1 lb. to 3 or 4 gals. water, or kerosene emulsion are effective remedies. *A. brassicae*, which is most destructive in the autumn, can be controlled in a similar way. *Scapteriscus didactylus*, the mole cricket, has probably been introduced into the south-eastern part of Georgia from Porto Rico. It feeds on potato, turnip, tomato, sugar-cane, etc. One brood is produced during the year ; the eggs are laid in the earth during April, May and June. The eggs hatch in from 24 to 26 days and from 8 to 12 months elapse before the adult stage is reached. The exposure of the eggs to the sun by ploughing is the best method of destroying them. Poisoned bait has been used with good results. The cutworms, *Lycophotia margaritosa* (*Peridroma saucia*) and *Agrotis ypsilon*, can be controlled by clean cultivation and the use of poisoned bait. *Hellula undalis*, F., has been abundant during 1914. The larva feeds at the base of the leaves of turnip and cabbage plants. Spraying with lead arsenate at the rate of 2 lb. to 50 gals. water, is effective when the larvae first appear. Delay in spraying renders the operation less successful, owing to the formation of webs over the leaves. *Diaphania nitidalis* and *D. hyalinata* are common pests of cucumber, melon and cantaloupes [see this *Review*, Ser. A, i, p. 219]. *Melittia satyriniformis*, the squash-vine borer, has

two generations a year in Georgia. The winter is passed in the ground in the pupal stage ; the second brood of larvae hatches out late in June, and the pupae of this generation emerge as adults in the following spring. The tomato horn worm, *Protoparce* (*Phlegethontius*) *sexta*, is normally controlled by parasites. The eggs are deposited on the under surface of the leaves of tomato, tobacco, egg-plant, etc. The larvae are subject to a bacterial disease. Dusting or spraying with lead arsenate is an effective remedy. Deep autumn and winter ploughing is advisable. *Chloridea* (*Heliothis*) *obsoleta* attacks cotton, tomatoes, corn and beans. Winter-ploughing destroys hibernating pupae ; direct remedies, such as spraying, have not proved successful. The three important cabbage worms are *Phytometra* (*Autographa*) *brassicae*, *Pieris* (*Pontia*) *rapae* and *P. protodice*. The Colorado potato beetle, *Leptinotarsa decemlineata*, Say., is common throughout the state. *Diabrotica vittata*, F., attacks cucumber and related plants. Cloth or netting is satisfactory in protecting the plants from attack. Spraying with Bordeaux mixture or dusting with a mixture of Paris green and air-slaked lime, gives good results. *Epitrix cucumeris* can be controlled by the use of Bordeaux mixture. A number of formulae for the preparation of spraying mixtures and a brief description of spraying pumps now in use, are given.

HARNED (R. W.). **Spraying Peaches and Plums.**—*Mississipi Agric. Expt. Sta.*, Press circ., 16th March 1915.

Brown rot and plum curculio (*Conotrachelus nenuphar*), on peaches and plums, are best controlled by the use of self-boiled lime-sulphur mixture and arsenate of lead. The lime-sulphur is prepared as follows : 8lb. fresh lime are covered with cold water and to this is gradually added 8 lb. sulphur. The mixture is stirred constantly and diluted to a thin paste. The slaking of the lime supplies sufficient heat to boil the water for several minutes. When cool, the mixture should be strained and diluted to 50 (U.S.) gals. Arsenate of lead is added at the rate of 2 lb. to 50 gals. of mixture. The first application should be made 2–4 weeks after the petals fall. A month later, lime-sulphur should be used alone. Both upper and under sides of the leaves should be sprayed.

HARNED (R. W.). **May Beetles and Pecan Trees.**—*Mississipi Agric. Expt. Sta.*, Press circ., 24th April 1915.

Lachnosterna sp. has been recorded from many parts of Mississippi as a pest of young pecan trees. The leaves and buds are eaten at night by the adult beetles. Control measures consist of frequent ploughing to destroy larvae and pupae, collection at night, and spraying with lead arsenate or Paris green. Pigs destroy large numbers of the larvae.

FELT (E. P.). **Twenty-ninth Report of the State Entomologist, 1913.**—*New York State Museum, Albany, N.Y.*, Bull. no. 175, 15th April 1915, pp. 257, 36 figs., 16 plates.

The year ending 30th September 1913 is covered by this report. Fruit-tree pests :—*Malacosoma americana*, F., (apple tent caterpillar)

devoured the leaves of many orchard and wild cherry trees and stripped trees in apple orchards, while the forest tent caterpillar (*M. disstria*) defoliated extensive areas of oak, and also attacked sugar-maples and poplars. The injury resulted in the loss of practically the entire apple crop in some places where the trees had not been sprayed. A modification of habit in *Conotrachelus nenuphar*, Hbst., (plum curculio) was caused by a late frost, which killed the plums locally at Nassau. The weevils attacked and severely injured the young fruit on an adjacent crab-apple tree, though comparatively few of the grubs developed successfully. In seasons when plums were available, this tree was practically free from the pest. *Taeniothrips* (*Euthrips*) *pyri*, Daniel, (the pear thrips) was abundant near Hudson and was, for the most part, controlled by timely and thorough applications of tobacco extract. This pest is an extremely local one; it works so rapidly and seeks shelter so persistently that careful selection of the time for spraying is essential. Injuries by red bugs, *Heterocordylus malinus* and *Lygidea mendax*, were very abundant in an orchard near Poughkeepsie. These pests seem very susceptible to tobacco preparations, the young being destroyed by a Black Leaf extract diluted 1 to 65 or Black Leaf 40, 1 to 800. Where practicable, the winter application for San José scale, *Aspidiotus perniciosus*, may be delayed as late as possible and three-fourths of a pint of Black Leaf extract added to each 100 U.S. gallons ($83\frac{1}{4}$ Impl.) for the purpose of destroying red bug, as well as San José scale; this treatment would also be very effective in checking aphids. *Psylla pyricola*, Riley, (the pear psylla) was a pest of considerable importance. The practical value of late spring applications of a lime-sulphur wash for the control of this insect, was demonstrated in a badly infested orchard, where one spraying during the third week in April practically annihilated the pest. Scraping the rough bark from the trunks of the older trees materially reduces the number of winter shelters. Aphids were somewhat abundant, especially on young trees, early in the season. They were reported to be almost absent from young trees which had been very badly infested the preceding season and had then been thoroughly sprayed with a whale oil soap solution, 1 lb. to 12 U.S. gals. (10 gals. Impl.) of water. The black grubs of *Adalia bipunctata*, L., (the two-spotted lady-beetle), the white-tufted larvae of *Hyperaspis signata* var. *binotata*, and Syrphid larvae were very useful in checking aphid injury. *Aspidiotus perniciosus* did not cause appreciable injury in orchards which were systematically sprayed, though, occasionally, neglected trees became very badly infested. Even under such conditions, one thorough application will check this pest most effectively. Parasites of the scale were abundant, including, in order of importance, *Prospaltella perniciosi*, Tower, *Aphelinus fuscipennis*, How., *Coccophagus immaculatus*, How., *Chiloneurus* sp. and *Psyllaephagus* sp. Under certain conditions, the last-named might be of greater importance than the two preceding ones. From Rochester, *Lycophotia margaritosa* (*Agrotis saucia*), the variegated cutworm, was reported to be feeding on clover and fallen apples. Though this cutworm is a climbing species, there was no evidence to show that it had ascended the trees and attacked the fruit while still upon them.

Shade-tree pests:—*Galerucella luteola*, Müll., (the elm leaf beetle) was greatly checked during recent years by thorough and systematic

spraying. Early in the spring of 1913, unsprayed trees seemed likely to suffer very severe injury, but they remained comparatively immune from attack, probably owing to the exceptionally cool weather in June, a time when oviposition by this pest is at its height. *Tetraneura ulmisacculi*, Patch, (the English elm pouch gall) represents an addition, probably of English origin, to the State fauna. Galls were found on *Ulmus campestris* (the English elm); there was only a scattered infestation and no serious injury resulted. *Phenacoccus acericola*, King, (the false maple scale) was the cause of a number of complaints, though it was distinctly less numerous than in recent years. It was extremely abundant during late summer in one locality near Mount Vernon; from material collected there, a number of small parasites and the beneficial Coccinellid, *Hyperaspis signata* var. *binotata*, were obtained. Specimens of Norway spruce infested by *Physokermes piceae*, Schr., (the spruce bud scale) were received from Mount Vernon. *Toumeyella liriodendri* (the tulip tree scale) was unusually numerous near New York. Several natural enemies were noticed preying upon this Coccid.

Forest tree pests:—*Malacosoma disstria*, Hbn. (the forest tent caterpillar) was injurious on a more extended scale than in the preceding year. The natural enemies observed include Tachinid and Sarcophagid flies, a number of Hymenoptera, particularly *Pimpla* sp., and a large Carabid beetle. The Longicorn, *Cyllene robiniae*, Forst. (the locust borer) has caused serious damage, it being unusual to find any number of black locust trees in the State uninfested; as a rule, however, the damage is confined largely to dying branches and the deformation of old trees. At present, it appears unwise to plant the black locust in localities where this borer is abundant and destructive. A general adoption of the plan of cutting and destroying very badly infested trees or parts of trees before the first of August, in order to prevent the insects maturing, would probably result in a very satisfactory control. The hibernating larvae may be destroyed by spraying with a strong solution of kerosene emulsion, not later than the first of April, great care being taken not to injure the trees. Some trees appear to be more resistant to attack than others, and it has been suggested that work on these lines might be attempted in the case of the black locust. *Mindarus abietinus*, Koch, (the spruce aphid) was reported on spruce; in one case, some tips of affected balsams bore a number of 15-spotted lady-beetles, *Anatis ocellata*, and practically no aphids, indicating that natural enemies were checking the pest early. The period of severe injury from *Scolytus* (*Eccoptogaster*) *quadrispinosus* Say, (the hickory bark beetle) is believed to be largely passed. The extensive plantings of white pine in recent years have given *Pissodes strobi* (the white pine weevil) almost ideal conditions for multiplication and there were numerous complaints of it. A practical test of the value of hand collection showed that four collections could be made at a cost of about five shillings per acre where the trees were three feet high or less, and, as a result, no weevils were seen later. Other forest pests which were studied were *Melanophila fulvoguttata*, Harr., (the spotted hemlock borer), *Aegeria* (*Sesia*) *rhododendri*, Bent., (the rhododendron clear-wing), *Corthylus punctatissimus*, Zimm., (the pitted ambrosia beetle) and *Agrilus bilineatus*, Web., (the two-lined chestnut borer). Other injurious insects dealt with in the report are *Cydia*

pomonella (the codling moth), *Oligia* (*Hadena*) *fractilinea*, Grote (the lined corn borer), *Tinea granella*, L., (the European grain moth or wolf moth), *Gracilaria Zachrysa*, Meyr. (*azaleae*, Busck) (the azalea leaf skeletonizer), *Argyresthia thuiella*, Pack., and *Itonida opuntiae*, Felt, (the cactus midge). Species of *Opuntia* may be injured by the deep red larvae of the cactus midge and most seriously affected by a bacterial or fungus disease which gains access to the inner tissues through the injuries. This fungus or bacterium is most destructive, but its spread is apparently dependent, so far as cacti are concerned, upon the work of the midge larvae. *I. opuntiae* may prove of value as an agent of destruction of the prickly pear [see this *Review*, Ser. A. iii, p. 126].

HIGH (M. M.). **The Huisache Girdler.** *U. S. Dept. Agric., Washington, D.C.*, Bull. no. 184, 8th April 1915, 9 pp., 4 plates, 2 tables.

Oncideres putator, the huisache girdler, is a dangerous pest and has been recorded from Arizona, New Mexico, Texas, and Mexico. It attacks *Acacia farnesiana*, *A. berlandieri*, *Prosopis glandulosa* and *Mimosa lindheimeri*. Damage is caused by the severing of the smaller branches by the adult for the purpose of oviposition. The adults emerge from the pupal cavities from September to November. Eggs are deposited in cavities, which have been prepared by the female in the bark of the tree. In the allied species, *O. cingulata* and *O. texana*, these cavities are sealed by a waxy secretion. The rate of growth of the larva is more rapid when there is sufficient moisture to permit constant feeding. The duration of the larval period within the branch is about 42 weeks; when ready to pupate, a hole is bored through the bark for the emergence of the adult. The pupal stage lasts four weeks. There is one generation each year, about 12 months being required for the life-cycle. The following natural enemies have been recorded: The Chalcids, *Chryseida inopinata* and *Eurytoma* sp., and the Braconids, *Caenophanes* sp. and *Meteorus* sp., are parasitic on the eggs and larvae, while the birds, *Dryobates pubescens* and *D. scalaris bairdi* destroy the larvae. The egg, larval and pupal stages can be artificially controlled by burning the branches attacked, from the first week in January to August. Hand collection of the beetles may be employed if only a few trees are attacked.

BROOKS (F. E.) & BLAKESLEE (E. B.). **Studies of the Codling Moth in the Central Appalachian Region.** *U.S. Dept. Agric., Washington, D.C.*, Bull. no. 189, 12th April 1915, 49 pp., 23 figs., 1 plate, 42 tables.

This paper is based upon experiments with bands against *Cydia pomonella*, conducted in 1911, 1912 and 1913, in several different localities in Virginia, West Virginia and Maryland, including a variation in latitude of about 1° 40′ and in altitude of about 3,100 feet. Suitable apple trees were banded with strips of burlap, and the larvae found beneath the bands were collected and reared in jars, kept in the localities where they were found. Examinations of the bands and rearing jars were made every week or ten days in 1911, and twice weekly in 1912 and 1913. In the regions mentioned, *Cydia pomonella* produces a full brood of larvae and a partial second one, the size of which depends

more or less on the latitude and altitude of the locality. There was a marked difference in the time of appearance of the different broods in different localities. There seems, however, to be no constant rate of difference between the earlier and later localities, largely owing to the response of the insect during its metamorphis to local and transient weather conditions. In the localities of different altitude, there is a greater difference in the time of the regular periodical changes of the insect that occur late in the season than of those that occur early, which may be due to the cumulative retarding effect of the more frequent unfavourable weather conditions at the higher elevation. The records indicate that 41·49 per cent. of the larvae drop to the ground and then ascend the trunk to pupate, and 58·51 per cent. crawl down the branches from the infested fruit to pupate. A considerable loss, due to cannibalism, occurs when a collection of larvae is confined in one jar, and it is probable that the weaker larvae are sometimes devoured by their fellows under normal conditions. The ants, *Solenopsis molesta*, Say, and *Lasius niger*, L., var. *americana*, Emery, were found in several localities devouring codling-moth larvae. Larvae and adults of the beetle, *Tenebroides corticalis*, Melsh., were frequently found feeding on them. Six species of Hymenopterous and one of Dipterous parasites were reared. Of these, the most destructive were the Braconid, *Ascogaster carpocapsae*, Vier., and the Ichneumonid, *Pimpla* (*Itoplectis*) *marginatus*, Prov. Hairworm parasites, *Mermis* sp., were abundant in one locality and very materially reduced the number of wintering larvae in 1911.

JONES (T. H.). **Insects affecting vegetable crops in Porto Rico.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 192, 8th April 1915, 11 pp., 4 plates.

Among Thysanoptera and Hemiptera, the following are the most important pests of vegetable crops: *Thrips tabaci* on onions; *Peregrinus maidis*, *Eutettix tenella*, *Empoasca mali* and *Aphis gossypii* on cucumber. The last-named is attacked by a parasite, probably *Aphidius testaceipes*, Cress. A fungus, *Acrostalagmus albus*, attacks various aphids and at least five species of Coccinellids feed upon them. *Aleurodes* sp. has been observed on tomatoes. *Saissetia hemisphaerica* and *Hemichionaspis minor* occur on egg-plant, and *Aulacaspis* (*Diaspis*) *pentagona* on okra and pepper. *Pseudococcus* sp. has been found on the roots of celery and maize. The Coreid bug, *Spartocera batatas*, has been observed on the stalks and leaf petioles of the sweet potato, and the Tingid, *Corythuca gossypii*, breeds on the under sides of the leaves of yautia, *Canavalia ensiformis* and *Ricinus communis*. Another Coreid, *Phthia pica*, Drury, attacks tomato and *Solanum nigrum*. *Corythaica monacha* has been observed on the leaves of the egg-plant. The most injurious Orthopteron is *Scapteriscus didactylus*, which destroys many vegetables by cutting off the plants at or just below the surface of the soil.

Among Coleoptera, the following have been observed: *Diabrotica bivittata*, *D. innuba* and *D. graminea*, the first two feeding on cucumber, squash and melon, the last on the leaves of sugar-cane, maize, *Spondias lutea* and *Amaranthus spinosus*. *Cerotoma denticornis* occurs on beans

and cowpeas; *Epitrix cucumeris* and *Chaetocnema apricaria* on egg-plant and tomato; *Coptocycla signifera*, *Euscepes* (*Cryptorhynchus*) *batatae* and *Cylas formicarius* on sweet potato.

Of the Lepidoptera, *Pieris monuste*, the southern cabbage worm, feeds on cabbage, radish, turnip, kale and mustard; *Protoparce* (*Phlegethontius*) *sexta* occurs on tomato and tobacco; *Laphygma frugiperda* attack maize and onions. This species has several parasitic enemies, including the Tachinids, *Frontina archippivora*, *Gonia crassicornis* and *Archytas piliventris*, and the Chalcid, *Chelonus insularis*; while the Reduviid, *Zelus rubidus*, and the Carabids, *Calosoma alternans* and *Cymindis marginalis*, are predaceous upon the larva. *Chloridea* (*Heliothis*) *obsoleta*, the corn ear worm, is an important pest. Three species of Noctuid moths have been recorded: *Xylomyges eridania*, *Prodenia ornithogalli* and *Feltia annexa*. *Pachyzancla bipunctalis*, the beet worm, has been found feeding on garden beans, sword beans and *Amaranthus* sp.; *Exorista pyste*, Walk., a Tachinid parasite of the larva, has been observed. *P. periusalis* feeds on the leaves of egg-plant and *Solanum torvum*; the larvae live at first as miners in the leaves, but later web the leaves together. The larvae of *Plutella maculipennis*, the diamond-back moth, are sometimes very abundant and destructive to the leaves of cabbage. A single Hymenopteron, *Solenopsis geminata*, on okra, and a Dipteron, *Agromyza parvicornis*, on maize, have been observed.

AFANASIEV (A. P.). **Русское виноградарство въ 1914 году (1-й вегетаціонный періодъ).** [Russian viticulture in 1914 (The 1st vegetative period).]—**«Вѣстникъ Винодѣлія.»** [*Herald of Viticulture*], *Odessa*, nos. 1–2 & 3–4, January–April 1915, pp. 40–60, 92–125.

The information on the general state of viticulture in Russia during the first period of 1914 contained in this article, is a summary of local correspondence from various places in 17 governments and provinces comprising the vine-growing areas of S. Russia and the Caucasus. Except for *Phylloxera* in Bessarabia and Transcaucasia, the season under report was very favourable. The following are the facts as to pes s from individual localities.

In Bessarabia, the chief pests were: *Phylloxera*, *Epicometis* (*Tropinota*) *hirta*, *Clysia ambiguella* and *Eriophyes* (*Phytoptus*) *vitis*. In Kishinev, large outbreaks occurred of *Melolontha* sp. and *Lethrus cephalotes* Against these pests, holes about 6 inches deep were made with a stick near their burrows in the morning, in which, in the afternoon, the insects were trapped and destroyed. The governments of Podolia and Ekaterinoslav were practically free from vine pests. In the government of Cherson, in the districts bordering on Bessarabia, serious damage was done by *Lethrus cephalotes*. In Taurida, along the Dnieper, *Polyphylla fullo*, L., was noticed in one locality and was either collected by hand during reploughing or destroyed by ducks. In the Crimea, *Eriophyes* sp. and *Otiorrhynchus* sp. were reported; the weevils were collected from 8 to 12 p.m. with lanterns, or were collected during the day under stones specially laid for this purpose. *Ino ampelophaga* also occurred. A large outbreak of CURCULIONIDAE occurred near Enikale. Near Bordiansk, *Clysia ambiguella* occurred in large numbers; hand-picking the caterpillars proved very effective. Paris

green, green soap and Persian powder was also used. *Lethrus cephalotes*, *Epicometis hirta* and *Eriophyes vitis* were also reported.

Province of the Don: In the central districts, *Lethrus cephalotes* (after the middle of April) *Epicometis hirta* (between 26th April and 28th May) and *Eriophyes vitis* (after the appearance of the first leaves) were reported. In the South, *Otiorrhynchus* sp. also occurred. In Astrachan, *E. vitis* and *Polychrosis botrana* were present.

In the Province of Terek: Two species of Curculionids are reported from the district of Modok. Hand collection and tobacco dust were used.

In the Province of Kuban, *Ino ampelophaga* played havoc with the vinestocks in some localities, especially where the vineyards were cultivated late; hand collection was adopted, as spraying with barium chloride did not give good results.

In the govt. of Tchernomorsk (Black Sea), the chief pests were, two species of Curculionids, *Ino ampelophaga*, *Otiorrhynchus turca*, *Eriophyes* sp. and *Cecidomyia* sp.; the last two were controlled by cutting away and burning the infested leaves. In the govt. of Tiflis, *Melolontha* sp., *Ino* sp., *Phylloxera*, *Eriophyes vitis*, *Otiorrhynchus*, *Polychrosis botrana*, *Rhynchites betulae* and *Cecidomyia* sp. were all present.

In the Province of Dagestan, only *Ino ampelophaga* and *Eriophyes vitis* were reported.

SACHAROV (N.). **Гусеница** *Talis quercella Schiff.* **въ степяхъ Царевскаго уѣзда, Астраханской губ.** [The caterpillar of *Talis quercella*, Schiff., in the steppes of the Zarev district of the govt. of Astrachan.]—Reprint from **« Сельско-Хозяйственный Вѣстникъ Юго-Востока.»** [*Agricultural Messenger of the South-East*], *Saratov*, no. 4, 1915, 12 pp., 6 figs.

Caterpillars which did great damage to fodder grasses and young wheat in Zarev in April 1914, were first identified as those of *Crambus luteellus*, Schiff., but, later, proved to be those of *Talis quercella*, Schiff. When the author arrived on 5th May, the caterpillars had almost totally destroyed *Poa bulbosa*, L., var. *vivipara*, L., which is common amongst the steppe grasses, some 810 acres of steppe plants and several acres of young wheat. The caterpillars were found in holes in the surface of the soil. The whole steppe was covered with these holes, which were 2 or 3 inches deep, their openings being wholly or partly covered with web, while some of the openings were connected by a tunnel, constructed of fragments of earth entangled in web with the nearest roots. The caterpillars are thought to remain in these holes throughout their life, gradually enlarging the diameter as they grow and pupating in them. They pass the day inside the holes, emerging at night in search of food. They did not eat broad-leaved plants, such as wormwood, *Euphorbia*, Cruciferae, Compositae, etc. The damage to wheat was similar to that caused by caterpillars of *Euxoa segetum*, Schiff., but no holes were present in the wheat fields, the caterpillars there hiding in the earth, underneath lumps, being mostly concentrated round the remaining crops. Wheat, as well as *Poa bulbosa*, was either totally devoured, or the roots destroyed. When the same spot was visited on 5th July they were found in a state of

diapause in their holes, the openings of which were closed with pieces of stems of *Poa bulbosa* mixed with web. The caterpillars remained in a state of diapause from May to July. The appearance of this pest is closely connected with the yield of *Poa bulbosa*, which does not produce a crop every year. The various stages of the insect are described and figured. The imagines began to appear on 1st August. In captivity the females oviposited in the earth, and this probably occurs also in Nature. As remedies, trenches about 14–21 inches deep and 10–14 inches wide should be dug immediately after sowing, in the latter half of April, on the edges of wheat fields, where they adjoin virgin soil over-grown with *Poa bulbosa*. The trenches must be inspected every morning and the caterpillars destroyed, otherwise they may burrow into the bottoms of the trenches.

ZOLOTAREVSKY (B. N.). **Предварительный отчетъ о работахъ по Энтомологiи въ 1914 г.** [Preliminary report on the work on Entomology in 1914.]—Published by the Stavropol-Caucasian Agricultural Experimental Station of the Stavropol Municipal Authority, *Stavropol*, 1915, 12 pp.

This is the first report of the Entomological Branch, established in 1914 at the Agricultural Experiment Station of the Municipality of Stavropol, and it contains the following list of insects found in the area inspected during the first year. Thysanoptera: Thrips were found in considerable numbers on winter-sown wheat; Hemiptera. *Schirus sexmaculatus*, Ramb., on field boundaries, lucerne, sown grasses; *Eurygaster austriacus*, Schrk., on barley; *Eurygaster integriceps*, Put., common on winter-sown wheat and barley; the first egg-masses were found on 30th May; larvae of various stages and young adults were found on summer sown wheat on 27th July; *Aelia acuminata*, L., and *A. rostrata*, Boh., on wheat and barley, and on wild grasses; *Aelia sibirica*, Reut., on winter-sown barley; *Dolycoris baccarum*, L., on lucerne and on summer wheat; *Eurydema festivum*, L., var. *decoratum*, H.S., and *E. oleraceum*, L., on hay; *Syromastis* (*Mesocerus*) *marginatus*, L., on field boundaries, summer wheat, vetches, and oats; *Coreus* (*Coriomeris*) *denticulatus*, Scop., on hay; *Rhopalus* (*Brachycarenus*) *tigrinus*, Schill., on summer wheat; *Myrmus miriformis*, Fall., on cut grasses; *Piocoris erythrocephalus*, Lep., on hay; *Oxycarenus collaris*, M.R., on cut grasses; *Scolopostethus affinis*, Schill., on summer barley, lucerne and summer wheat; *Tingis* (*Tropidochila*) *pilosa*, Humm., on winter barley; *Nabis* (*Reduviolus*) *ferus*, L., on wheat, lucerne and harvested hay. *Adelphocoris lineolatus*, Goeze, has done great damage to lucerne and was also found on harvested hay and on buckwheat; *Lygus pratensis*, L., on summer and winter wheat, oats, barley, lucerne, linseed, and on vetches with oats; *Poeciloscytus cognatus*, Fieb., on lucerne, summer wheat and harvested hay; *Notostira erratica*, L., on hay and summer barley; *Trigonotylus ruficornis*, Geoffr., was noticed in considerable numbers on cultivated and wild grasses, and in July was taken on summer wheat and harvested hay; *Miris ferrugatus*, Fall., and *Orthocephalus vittipennis*, H. S., on harvested hay; *Plagiognathus chrysanthemi*, Wolff, on harvested hay and lucerne; *P. arbustorum*, F., on summer wheat and on

vetches with oats; *P. albipennis*, Fall., on harvested hay; *Chlamydatus pullus*, Reut., on summer wheat, lucerne, and vetches with oats. A large number of aphid colonies was observed on barley in June.

Lepidoptera: Caterpillars of *Agrotis* sp. injured maize around the edges of the fields.

Coleoptera: *Melanotus brunnipes*, Germ., was found in large numbers during June; larvae resembling the larvae of *Melanotus* were found on field potatoes, sugar-beet and maize and also on black fallow fields; *Blitophaga undata*, Müll., injured wheat and barley; the larvae of this pest were observed on sugar-beet in May Both the larvae and adults are found on all kinds of wild plants, having also been taken on lucerne and wheat. Larvae of *Lema melanopa*, L., were found on winter wheat, barley and oats. Both larvae and adults of *Otiorrhynchus ligustici*, L., injured lucerne. Several species of *Sitones* were observed on lucerne in large numbers. *Anisoplia segetum*, Herbst, occurred in the middle of June on winter wheat. *A. austriaca*, Herbst. was found rarely. *A. cyathigera*, Scop., was observed on winter wheat.

Diptera: *Diplosis* sp. was first noticed on 1st June and appeared in great numbers on winter wheat, which had just started to blossom; during the mornings and in windy weather, the insects remain on the roots of wheat, becoming more active with the approach of the evening; the larvae were found in ears of winter wheat on the 24th June. *Oscinis* sp. was found in large numbers during the whole summer, several generations occurring on barley and oats; no damage was noticed, owing to the insects ovipositing in summer on the secondary stems and apparently not affecting the grain; late sowings of barley however occasionally exhibited injuries to the central shoots.

Hymenoptera: *Cephus pygmaeus*, L., appeared after 21st May and in ever increasing numbers till the end of June and beginning of July, when they gradually diminished and disappeared on 16th July; they are apparently particularly fond of Cruciferous plants. Oviposition was first noticed on 24th May on winter-sown wheat; evidently the females prefer to oviposit on fully formed stems, as it was observed that they did not touch summer-sown wheat and gradually passed from the early to late-sown winter wheat; they appeared on summer wheat only on 11th June, when the latter produced ears. Winter wheat injured by the larvae was observed in the first half of July. *Trachelus tabidus*, F., appeared later than the previous species and is chiefly found therefore on summer-sown crops. A large number of the parasites, *Collyria calcitrator*, Grav., were found with both the above species; the parasites oviposit mostly in the evening.

Rushkovsky (I. A.). **Вредители сельскаго хозяйства Уфимской губерніи въ 1913 году.** [Pests of Agriculture in the govt. of Ufa in 1913.] Published by the Agronomical Department of the Zemstvo of the govt. of Ufa, *Ufa*, 1914, 29 pp. [Received 19th July 1915.]

The author, who was deputed by the Department of Agriculture, by request of the Zemstvo of Ufa, to investigate the local insect pests, gives a report of his work. This was not completed, as the time allowed did not permit an investigation of the whole area of over 44,000 square

miles. The following is a list of the pests observed :—Pests of seedling grain-crops :— *Oscinella* (*Oscinis*) *frit*; *Chaetocnema aridula*, Gyl.; *Cicadula sexnotata*, Fall., frequently accompanied by *Deltocephalus striatus*, L., was present everywhere; *Agriotes lineatus* L.; *Trigonotylus ruficornis*, Geoffr.; *Chlorops taeniopus*, Meig; *Phyllotreta vittula*, Redt., on young winter wheat; *Mayetiola* (*Cecidomyia*) *destructor*, Say; *Lasioptera cerealis*, Lind., the larvae of which injured young rye, a large number of *Oxythyrea funesta*, Poda (*stictica*, L.) being also found in the ears.

Pests of wheat and rye in the ear : *Aelia acuminata*, L.; *Eurygaster maura*, L.; *Anisoplia aprica* var. *brenskei*, Reit., found in large numbers, mostly on rye, less frequently on wheat; *Trachea basilinea*, Schiff.; *Limothrips denticornis*, Hal., *Haplothrips aculeata*, Uzel, and an unidentified species of *Thrips*, present in very large numbers; *Oscinella* (*Oscinis*) *frit*, L.; *Mayetiola destructor*, Say, and *Chlorops taeniopus*, Meig.; *Siphonophora cerealis*, Kalt.; *Amphimallus solstitialis*, L., and *Lema melanopa*, L.

Pests of peas : *Sitones crinitus*, Ol., *S. sulcifrons*, Thunb.; *Polia* (*Mamestra*) *pisi*, L.; *Siphonophora pisi*, Kalt., which did great damage in some parts, but was checked by the following enemies : *Coccinella 7-punctata*, L., *C. conglobata*, L., and the Syrphids *Sphaerophoria* (*Melithreptus*) *scripta*, L., and *Melanastoma mellinum*, L.: *Cydia* (*Grapholitha*) *dorsana*, F., destroys the peas inside the pods.

Pests of cruciferous crops : *Phyllotreta sinuata*, Steph.; *Meligethes brassicae*, Scop.*; *Psylliodes chrysocephalus*, L.; *Phyllotreta nemorum*, L., the last three species being found on mustard; *Meligethes* sp. was also found on rape.

Pests of clover, lucerne and buckwheat : *Sitones crinitus*, Ol.; *S. sulcifrons*, Thunb.; *S. tibialis*, Germ.; *Apion apricans*, Hrbst.; *Pedinus femoralis*, L. No pests of linseed were found, but hemp was injured by *Psylliodes attenuatus*, Koch.

Pests of market-gardens : *Barathra* (*Mamestra*) *brassicae*, L.; *Eurydema* (*Strachia*) *oleraceum*, L. and *Eurydema festivum* var. *decoratum*, H. S. (*Strachia pustulata*, Fieb.); *Athalia spinarum*, F.; *Plutella maculipennis*, Curt. (*cruciferarum* Zell.), all of which injured cabbage; fodder-beet was injured by larvae of *Melolontha hippocastani*, F., and by caterpillars of *Agrotis* sp.; while carrots were injured by larvae of *Agriotes lineatus*, L.

Pests of poppy : *Aphis rumicis*, L., (*papaveris*, F.) and probably *Ceuthorrhynchus macula-alba*, Hrbst. Sunflowers were injured by caterpillars of *Homoeosoma nebullela*, Hb., and asparagus by *Crioceris 5-punctata*, L., and *C. 12-punctata*, L. Bush-fruit was damaged by *Pteronus ribesii*, L., (*Nematus ventricosus*, Kl.), *Selandria morio*, F., and other species of TENTHREDINIDAE.

Pests of orchards : *Hyponomeuta malinellus*, Zell., from the cocoons of which the author has reared the Ichneumons, *Pimpla examinator*, F., and *Angitia* (*Limnerium*) *tibialis*, Grav., and some hyperparasites belonging to the genus *Tetrastichus*; *Cydia pomonella*, L.; *Aporia crataegi*, L.; *Argyresthia conjugella*, Zell.; *Aphis pomi*, de Geer; *Eriocampoides limacina*, L., (*Eriocampa adumbrata*, Kl.); while in

[* The identity of this species is uncertain.—ED.]

the localities where *Malacosoma* (*Lasiocampa*) *neustria*, L., and *Lymantria* (*Ocneria*) *dispar*, L., were prevalent, they also invaded orchards.

Forest-pests: large outbreaks of *L. dispar* occurred, being usually accompanied by *M. neustria*, L.; oaks were injured by *Tischeria complanella*, Hb., and by caterpillars of an unidentified moth. The following Orthoptera are also recorded: *Podisma* (*Pezotettix*) *pedestris*, Burm., *Arcyptera* (*Stethophyma*) *flavicosta*, Fish., *Psophus stridulus*, L. and *Calliptamus* (*Caloptenus*) *italicus*, L., but none of them were numerous.

Averin (V. G.). **Календарь борьбы съ вредителями. Февраль-Мартъ.** [Calendar for the control of pests. February–March.] —**« Бюллетень о вредителяхъ сельскаго хозяйства и мѣрахъ борьбы съ ними.»** [*Bulletins on pests of Agriculture and methods of control.*] Published by the Entomological and Phytopathological Bureau of the Zemstvo of the govt. of Charkov, *Charkov*, no. 2, February 1915, pp. 31–34, 3 figs.

In February, it is necessary to clean the bark of fruit trees and burn the old bark, in which various pests, such as *Cydia pomonella*, Curculionidae, etc., winter. The nests and eggs of *Lymantria dispar*, *Aporia crataegi*, *Euproctis chrysorrhoea* and *Malacosoma neustria* must be removed and the trees smeared with carbolic emulsion against scale-insects. In March, all trees must be sprayed with a solution of 10 lb. of lime and 10 lb. of iron sulphate in 27 gallons of water, and in localities where *Rhynchites pauxillus*, Germ., is an active pest, two parts of clay must be added for every part of lime.

Andreiev (B.). **Англійскій рынокъ для сушенныхъ овощей.** [The English market for dried vegetables.]—**« Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 4, April 1915, pp. 240–243.

Complaints have been made in England as to the low quality of dried peas exported from Russia, which is attributed to infestation with *Bruchus pisorum*, L. (*pisi*, L.). A short account of the life-history of this pest is given, with remedies for it. It winters as an adult, which emerges early in spring. Oviposition takes place on the pods and the young larvae live inside the peas, pupate there, and produce adults in autumn. When the temperature in the stores, where the peas are kept, is low, the beetles remain inside them over the winter. The cultivation of marrow-fat peas, an immune variety, is advised. Peas should be sown in two periods, the first one being a trap-crop, which is mown down and used as fodder for cattle when half-grown. Peas for sowing, must be disinfected with carbon-bisulphide, about 1 lb. to every ton or ton and a half of peas.

Ossipov (N.). **,, Зимняя пяденица '' и весенняя борьба съ ея гусеницей.** [*Cheimatobia brumata*, L., and the control of its caterpillars in spring.] **« Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 4, April 1915, pp. 249–253.

In the northern governments of Russia, the adults of *Cheimatobia brumata* appear in the second half of September; in the central

governments, in the first half of October, and in South Russia, at the end of that month and the beginning of November. The eggs remain over the winter and hatch in the spring of the next year (in Bessarabia, in the first half of April). The larval stage lasts six weeks, and pupation takes place in the earth, at a depth of 2–3½ inches, and lasts three months and frequently longer. Remedies include trap-belts to prevent the females, which cannot fly, from getting on the trees to oviposit and digging the soil of the orchard, followed by rolling, against the pupae. Where none of these remedies have been applied in autumn, the trees should be sprayed with some insecticide against the caterpillars. The author has obtained good results with the following recipe: 6 oz. of Paris green, 12 oz. of quick lime, 2½ lb. of green soap in 27 gallons of water, the soap being added to make the liquid adhesive. It is better to prepare it on a large scale, and 54 gallons may be prepared as follows:– About 48 gallons of water are poured into a wooden barrel, cut in half. The Paris green (mark 707) is moistened with some water into a paste and then washed into the barrel; the lime is slaked and, when thoroughly mixed with water, poured into the barrel; the soap is dissolved in some hot water, to which cold water is afterwards added to cool it, and the whole poured into the barrel. The remaining quantity of water is added and the bulk well stirred and mixed. It is advisable to spray twice; when the buds start to unfold and again after the blossoming.

PORTCHINSKY (I. A.). **Замѣтка по поводу статьи напечатанной въ №.2 «Садовода» 1915 г. подъ заглавіемъ: „Объ одномъ новомъ и малоизвѣстномъ полевомъ и огородномъ вредителѣ свеклы-черномъ цвѣтоѣдѣ** *Podonta nigrita*, F. [Note with reference to the article published in No. 2 of "Sadovod" [*The Horticulturist*], 1915, under the title: "On a new and little known field and market-garden pest of sugar-beet, *Podonta nigrita*."]— **«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 4, April 1915, pp. 243–244.

The author refers to an article published in the above journal on the Tenebrionid beetle, *Podonta nigrita*, in which it is stated that this insect is recorded for the first time in Russia, and that neither its life-history nor its various stages are known. He points out that he published in 1897, in No. 46 of the Bulletins of the Ministry of Agriculture and Crown Estates, a note on his observations on this insect, the larvae of which were discovered by him during his investigations on the parasites of the corn weevil. He then stated that the imagines of these pests injure grain and rape crops, while the larvae, which are similar to those of *Tenebrio molitor*, probably feed on the roots of plants. A parasite of the insect was also discovered, *Anthrax pygarga*, Lw., probably a variety of *A. ixion*, F., which, in one case, destroyed 50 per cent. of the larvae of *P. nigrita*.

[In this *Review*, Ser. A, iii, p. 94, E. Vassiliev's statement as to this insect is given from the report of the station at Smiela.]

G. S. **Итоги прошлаго года.** [The results of last year.]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 4, April 1915, pp. 276–278.

A correspondent from Syzran (government of Simbirsk) reports an unprecedented outbreak of *Hyponomeuta malinellus*, Zell., which began nearly simultaneously with the unfolding of the leaf buds on fruit trees in the spring of 1914, and resulted in very serious damage to the orchards of the district. Spraying with arsenic gave favourable results in some cases, but in others, owing to ignorant handling, damage to the trees resulted.

RIABOI (D. D.). **Самозащита плодовъ.** [The self-protection of fruits.] **«Бюллетень с вредителяхъ сельскаго хозяйства и мѣрахъ борьбы съ ними.»** [*Bulletins on pests of Agriculture and methods of control.*] Published by the Entomological and Phytopathological Bureau of the Zemstvo of the govt. of Charkov, *Charkov*, no. 4, April 1915, pp. 1–11, 9 figs.

The practice of fruit-growing tends to show that there are varieties of apples and pears which are less subject to attack by fungus diseases and by *Cydia pomonella*, than others, although no scientific data on this subject exist. During the investigations of the author on the structure of the ovaries of several varieties of apples, he found inside a "Princess Fosia" apple a peculiar burrow of a caterpillar of *C. pomonella*; having passed the subcalycinal tube in the direction of the ovaries, the caterpillar met with the walls of the carpels, turned backwards at a sharp angle, and passed out from the fruit. This and other similar observations give colour to the suggestion that the biting organs of the caterpillars are not sufficiently developed to penetrate the hard walls of the carpels, a suggestion which is supported also by the fact that when eating the seeds, the pests start gnawing from the lower end, where the skin of the seeds is quite soft and tender. Accordingly, he divides apples into two groups: (1) those which are not attacked by *C. pomonella* and which have firmly closed carpels of small dimensions, the inter-carpellary space being absent, and the carpel being situated low in the fruit; and (2) those which are attacked, having carpels through which access is easy, their walls being disconnected in the upper part, where the pollen tubes lie. These observations relate to fruits in their autumn stage, i.e., to the second and third generation of *C. pomonella*, and it may be that during the first period of the development of the fruits the walls of the carpels do not afford sufficient protection. This can be proved only by further observations, but even should it be the case, the existence of fruits immune against the second and third generations may be of great importance.

LIUBOMUDROV (I.). **Работы по борьбѣ съ вредителями садовъ ранней весной. (Отъ Кіевской Станціи по борьбѣ съ вредителями растеній).** [The work for the control of pests of orchards early in spring. (From the Kiev Station for the control of pests of plants).] -**«Хозяйство.»** [*Husbandry*], *Kiev*, x, no. 11, 2nd April 1915, pp. 296–298, 4 figs.

The principal work to be done in orchards in early spring, so as to

prevent outbreaks of insect pests and facilitate later control, is outlined, including the removal of the nests of *Aporia crataegi* and *Euproctis chrysorrhoea*, and the eggs of *Malacosoma neustria*, the general cleansing of the orchard and trees from débris, etc., spraying with milk of lime before the swelling of the buds, and the fixing of tanglefoot belts, the two last remedies being directed against *Anthonomus pomorum* and similar insects. Some information as to sprays and insecticides is also given.

BIELSKY (B. I.). **Весеннія мѣропріятія по борьбѣ съ вредителями полеводства.** [Spring remedies for the control of pests of field-crops.]—**«Хозяйство.»** [*Husbandry*], *Kiev*, no. 12, 16th April 1915, pp. 323–325.

Agriculturists are urged to pay more attention to various spring preventive remedies, which are necessitated by the scarcity of insecticides and the present high prices. Trenches should be dug round pea fields, in April, against *Sitones lineatus*, L., round sugar-beet plantations against *Bothynoderes* (*Cleonus*) *punctiventris*, Germ., and round various crops against *Lethrus apterus*, Laxm. Mineral manures should be used to diminish the damage from *Oscinella* (*Oscinis*) *frit*, against which trap-crops, preferably of barley, are also suggested.

DOMASHEVSKY D. **Разводите фазановъ!** [Breed pheasants!]—**«Лѣсной Журналъ.»** [*Forestry Journal*], *Petrograd*, xlv, no. 3, 1915, pp. 457–460. [Received 23rd June 1915.]

A large outbreak of *Phalera bucephaloides* occurred in 1912, which defoliated some 2,700 acres of oak. As outbreaks of this pest usually last for two years, it was expected that it would occur again in 1913. This, however, was not the case, which is believed to have been due to its having been checked by pheasants. The author records having found the pupae of this moth in the crops of these birds.

BALABANOV (M.). **Какъ бороться съ яблоневымъ цвѣтоѣдомъ.** [How to control *Anthonomus pomorum*.]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture & Market-Gardening*], *Petrograd*, xii, no. 14, 18th April 1915, pp. 438–439.

The difficulties presented by various remedies suggested for the control of *Anthonomus pomorum*, none of which fully attain their object, are here dealt with. Trap-belts, which undoubtedly tend to decrease the damage, do not, however, lead to the total destruction of this pest, as many females are able to fly over them to the crowns of the trees. Spraying with pure milk of lime drives away the insects, but in order to be effective, i.e., prevent oviposition, it must be done at the moment when the buds separate from one another and when the females are actually ovipositing. A delay in oviposition produced by spraying, if only for two or three days, will delay the emergence of the larvae and thus save the buds. Fruit-growers are invited to test the remedies recommended and to report on the results obtained.

Makaida (I.). **Какъ уничтожить тлю на плантаціяхъ огурцовъ, дынь и арбузовъ.** [How to destroy Aphids in cucumber, water-melon and melon plantations.]—**« Прогрессивное Садоводство и Огородничество.** [*Progressive Horticulture & Market-Gardening*], *Petrograd*, xii, no. 14, 18th April 1915, p. 433.

An experiment, conducted in 1914, on a farm of the Teachers College in Novomerkovsk, govt. of Ekaterinoslav, has proved that tomatoes provide an excellent remedy against aphids. The author therefore recommends planting tomatoes, preferably the early variety, "Ficarozzi," which does not require much tying up, close to cucumbers, melons and watermelons. When late varieties are used, it is necessary to tie up each bush, otherwise the cucumbers and melons may suffer from the dense shade. The tomatoes were planted in a chess-board pattern, and besides protecting the plantations, yielded a good crop. A neighbouring plantation not protected in this way, suffered greatly from aphids.

Ermakov (V.). **Морозы не вредятъ растеніямъ.** [Frosts do no harm to plants.]—**« Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture & Market-Gardening*], *Petrograd*, xii, no. 15, 25th April 1915, pp. 468–469.

The author refers to a previous article in which he stated, that, if ants be destroyed, plants can stand the winter without being covered. He repeats this statement after experiments lasting three years, during which, owing to careful control of the ants, roses, vines, peaches and apricots successfully passed the winter without cover. Aphids have nearly disappeared; there is no canker or gummosis and the trees yield yearly more fruit. He has come to the conclusion that ants mainly dwell at a considerable depth in the soil, and that in some orchards, only a small minority appear on the surface, the majority remaining the whole year underground. Bone meal was successfully used to keep down the ants. N. F. Kashtchenko has controlled ants with a very weak extract of fresh cow-dung, with good results.

О червѣ, поѣдающемъ хлѣба въ Изюмскомъ уѣздѣ. [On a caterpillar devouring grain-crops in the district of Izjum, govt. of Charkov.]—**« Южно-Русская Сельско-Хозяйственная Газета.** [*South Russian Agricultural Gazette*], *Charkov*, xvii, no. 14, 29th April 1915, p. 11.

This circular from the Entomological Bureau of the Zemstvo of Charkov advises farmers to be on their guard against a threatened outbreak of *Oria* (*Tapinostola*) *musculosa*, the caterpillars of which last year injured over 43,000 acres of crops in the district of Izjum. Stubbles and weeds on plots not ploughed the previous year should be burnt, or if the stubble be short, ploughed in; boundary strips should be mowed; plots which were damaged the previous year and on which no deep reploughing was carried out in autumn, should be sown with maize, buckwheat, millet, potatoes, bachza plants, etc., instead

of grain. If bare places be noticed in the fields, these must be immediately reploughed and resown with some of the above plants. Attention is also called to the necessity for removing and burning the waste of the maize harvest, in which the caterpillars of *Pyrausta nubilalis* (*Botys silacealis*) occur.

STRACHOV-KOLTCHIN (A. I.). **Амбарный долгоносикъ.** [*Calandra granaria*, L.].—**« Труды Воронежской Станціи по борьбѣ съ вредителями растеній.»** [*Memoirs of the Voronezh Station for the control of pests of plants*], *Voronezh*, pt. 1, 1915, 74 pp. 25 figs.

The observations described in this report were made by the author on behalf of the Entomological Station of the Zemstvo of Voronezh, during 1914. *Calandra granaria* is described and details of its life-history given. The life of the adults is closely related to the temperature surrounding them, and at 27° F. and below it they show no signs of life. At about 52° F. they live and feed nearly normally, but do not pair, this process only beginning at over 54·5° F. At 66·5° F. pairing and oviposition take place daily, one egg being deposited per diem. The eggs are deposited in grains of rye, wheat, maize, barley, oats, buckwheat, shelled millet—although, in the author's experiments, no larvae completed their development inside shelled millet, owing to its small size and the absence of husk causing the larvae to fall out—and also in macaroni, vermicelli and, probably, other preparations of flour. Wet grains are preferred to dry ones, and, other things being equal, rye is preferred to wheat. After the egg has been laid, the opening is closed with an adhesive substance exuded by the female, and placed in position by means of the ovipositor; this closely resembles the shell and is not easily distinguished even with a lens. Oviposition lasts throughout the summer until the arrival, in autumn, of a temperature of 53–54° F., but in warm stores and rooms it continues during the whole year. Several tables are given, illustrating the number of eggs laid under various conditions. A female is able to oviposit for three or four months and lives for from one to four weeks afterwards, while the males live two, three and even four months longer than the females. The development of the egg depends mainly on the temperature, excessive dryness being sometimes harmful, while excessive wetness has no influence, neither has light. A temperature below freezing may lead to the destruction of the egg. The whole life of the larva, as well as of the subsequent stages, is passed inside the grain. At a temperature of 63° F. the larval stage lasted 84 days, diminishing to 21½ days at 76½° F. The presence of moisture accelerates the development of the larvae. Even great humidity does not kill them and they are able to live even in wet decomposing, or rotting grain, although a larger percentage of them may become infested with fungus diseases under such conditions. The duration of the pupal stage depends on the temperature, lasting 22 days at 60° F., 16 days at 65° F., and 10 days at 71½° F. Up to a temperature of 75–77° F., the degree of moisture does not noticeably affect the duration of the pupal stage, but at higher temperatures moisture is essential for the development of the pupa. Having issued from the grain, the weevils feed practically without interruption day and night,

till they acquire a dark cinnamon colour, which coincides with their sexual maturity. They breed in barley more readily than in oats, rye or wheat and cannot breed in standing millet, peas, sunflowers or, generally speaking, in grains with a strong shell. Stores with iron roofs are more subject to fluctuations of temperature and provide less suitable conditions for *C. granaria*. The degree of moisture has a still greater effect, and should it be possible to keep the moisture of the grain below 11 per cent., the pests cannot breed in it. Currents of air have an indirect effect by lowering both the temperature and the degree of moisture and also a direct one, by disturbing the weevils ; light has no effect at all, for although the weevils avoid a bright light, they adapt themselves to it very rapidly. Several experiments are described, which were undertaken in order to ascertain the amount of damage done to grain ; in one experiment, 10 pairs of weevils were put into 600 grammes of grain on 28th May, the moisture being kept at 19 per cent. ; at the beginning of winter, 2,000 beetles were found inside this grain, of which 112 grammes were destroyed. In another experiment, 10 pairs were placed, on the same date, in 350 grammes of grain, the moisture of which was 16 per cent. ; at the beginning of winter, 1,000 weevils were present, the amount of grain destroyed being 65 grammes. In a similar experiment, where the degree of moisture was 14 per cent., 440 beetles were found and about 33 grammes of grain destroyed. Remedies are only indicated in a general way, but include drying the grain and keeping the moisture in the stores, etc., at a minimum, as well as the use of carbon bisulphide, naphthaline and tar. A high temperature tends to increase the effectiveness of carbon bisulphide.

ANDREWS (E. A.) & TUNSTALL (A. C.). **Notes on the Spraying of Tea.** —*Indian Tea Assoc., Calcutta*, no. 1, 1915, 75 pp., 9 plates.

All spray substances, used against tea pests, should be applied as soon as possible after the bushes have been plucked, consistent with applying the insecticide at the proper stage in the life-history of the insect. The Scarabaeid, *Serica assamensis*, attacks the tissues of old leaves. The bushes and the weeds beneath them, should be sprayed with lead chromate, preferably towards evening. The beetles and larvae may be captured in large numbers, in the daytime, by turning up the surface soil. Nitrolim forked into the soil round the bushes gives good results. The Chrysomelid, *Diapromorpha melanopus*, eats partly through the succulent stem of the shoot, eventually causing the leaves to drop. This insect comes from the jungle, and the destruction of the latter is the best means of eradicating it. The larvae of the Bombycid moth, *Andraca bipunctata*, frequently defoliate the bushes. Their habit of spending the day in clusters on the stem renders their capture easy. *Stauropus alternus* (the lobster caterpillar), can be controlled by spraying with lead arsenate. The eradication of the Zygaenid, *Heterusia magnifica*, is difficult. Spraying, if adopted, must be carried out with the object of driving the insects into a small area, when they can be easily caught. The larvae do not eat sprayed foliage, but can travel a considerable distance to an unsprayed bush. Spraying with lead chromate should begin some distance from the affected area and should be carried to the centre of this. Migration

may be restricted by a line of wood-ashes or crude petroleum. Ringing the bushes with an adhesive substance between 11 a.m. and 3 p.m. would prevent the larvae from climbing up them, but would have to be done over a large area. The bagworms, *Clania crameri*, *C. holmesi*, *C. variegata* and *Amatissa consorta* attack the leaves and bark. Collecting the cases at the beginning of the season is the best method of dealing with these pests. *Acanthopsyche reidi*, the limpet caterpillar, feeds on the upper epidermis or, in serious cases, on the bark. The bushes should be sprayed with lead chromate. *Thosea cervina*, the nettle grub, attacks the leaves; it possesses considerable stinging powers. Treatment is the same as for *A. reidi*. Another Limacodid, *Belippa bohor*, can be sprayed with lead chromate, but under ordinary conditions it is kept in check by a parasitic fly. *Arbela* spp. bore into branches at places where the bark is stripped. The larva emerges from the hole to feed and in so doing builds up a tube which adheres to the branch. Affected bushes should be treated in cold weather with alkali wash to soften the bark and render it less liable to attack. The removal of infested branches is also advised. *Biston suppressaria* can be almost completely eradicated by hand-forking round the bushes in cold weather and by the collection of pupae and moths. Spraying with lead chromate is useful against the larva. *Agriophara rhombota* fastens the leaves together by means of a web. The best treatment is thorough cleaning of the bushes when pruning and subsequent application of alkali solution. *Helopeltis theivora* (tea mosquito) punctures the leaves, producing characteristic brown patches. Young shoots are usually attacked. Sprays are useless in a severe attack; in cases where this pest has been held in check, combined spraying, hand-picking and cultural methods have been used. *Empoasca flavescens* produces a stunted growth of the shoots. Strong crude oil emulsion or potassium sulphide will kill the insects, but spraying must be thorough. The Aphid, *Ceylonica theaecola*, produces a marked curling of the leaves. Crude oil emulsion, resin solution or a weak solution of phenyl (1 in 200) are all effective remedies. The best treatment for various kinds of COCCIDAE is the application of soda or emulsion-soda in the cold weather, followed by resin solution in May or June. The solution may be sprayed or brushed on to the bushes. Recent researches have shown that Thrips may be caught by means of traps. These consist of small bowls containing ½ pt. water and a small quantity of benzaldehyde. The insects are attracted by the benzaldehyde and drowned in the water. The traps must be scattered about the affected area; each retains its efficiency for five or six days. Several species of termites are found in tea districts. The heartwood of living bushes is attacked and this ultimately results in the death of the affected plants. Cultivation and careful pruning are the best remedies. In the case of mound-forming species, the "Universal" White Ant Exterminator has been found useful. *Tetranychus bioculatus* sucks the juices from the older leaves, giving them a reddish brown appearance. In severe attacks, the leaves fall off, and the damage extends to the young shoots. Suitable insecticides are potassium sulphide, crude oil or kerosene emulsion and lime-sulphur solution. As none of these sprays will kill the eggs, a second spraying must be carried out four days later. The Acarid, *Brevipalpus obovatus*, is found on the under side of the leaf only.

Potassium sulphide or crude oil emulsion should be sprayed on to the bushes from below. *Eriophyes* (*Phytoptus*) *theae* can be controlled in a similar way. The most important spraying materials are enumerated and their preparation described. Caustic soda is useful as a contact insecticide against scale-insects. The most suitable strength is, caustic soda (98 per cent. purity) 2 lb., water 10 gals. The value of this solution is increased by the addition of kerosene. The mixture known as Woburn wash, consists of ½ lb. soft soap, 5 pints kerosene, 2 lb. caustic soda and 9½ gals. water. Soda copper emulsion and soda iron emulsion are similar preparations in which the soap is replaced by copper and iron respectively. Lead chromate is used at a strength of 1 lb. of the powder or 1½ lb. of paste in 60 gals. water. Resin, dissolved in soda, is useful against tea-aphis and scale-insects. An effective formula is 8 lb. resin, 1 lb. caustic soda and 30 gals. water. For use against thrips, the following formula is recommended: 2 lb. resin, 1 lb. washing soda, 2 gals. water. To this stock solution 6–10 gals. water are added. The paper concludes with a description of various spraying machines and the organisation of spraying operations.

Coconut Beetle Traps.—*Tropical Agric., Peradeniya,* xliv, no. 4, April 1915, p. 236.

Experiments have recently been conducted to determine whether a certain fungus discovered by Dr. Friederichs, is parasitic on *Oryctes rhinoceros*, the coconut beetle. Results have shown that the fungus is parasitic on the larva, but only to a limited extent. The fungus was grown on rice in order to obtain sufficient material for infecting beetle traps in the field, but these have, up to the present, given no results, as no beetles appear to have visited them to oviposit.

Girault (A. A.) & Dodd (A. P.). **The Cane Grubs of Australia.**—*Queensland Bureau of Sugar Expt. Sta., Div. of Entom., Brisbane,* Bull. no. 2, 1915, 60 pp.

The following data on various phases of the life-history and habits of cane beetles were obtained from insects collected at Gordonvale, Queensland. *Lepidiota albohirta* occurs as a larva in canefields of volcanic, sandy loam and clay-loam soils, in natural forest or bush, under the roots of corn and grasses, etc. The larvae subsist largely upon the organic matter in the soil, attacking living vegetation at the same time. Eggs are deposited in the soil at a depth of from 6 to 7 inches. The average duration of the larval stage is about two months. Pupae were found in October and November at a depth of from 3 to 15 inches; the length of the pupal stage exceeds 27 days. Adults occurred from November to March. The adults appear to emerge from the ground soon after sundown. Flight to a suitable tree near a canefield takes place and feeding begins at once. The beetles are quiescent during the night and during full daylight, flight only taking place in early morning and evening. *Ficus* spp. are the commonest food-plants of the adult. Banana, *Acacia* sp., *Eucalyptus corymbosa*, and *E. tessellaria* are also frequently attacked. *Lepidiota frenchi* occurs throughout north-east Queensland, and is found in both forest

and jungle soils, in canefields or under grasses. Pupae were found at a depth of from 2 to 3½ feet during the second week in June. The emergence of adults has been recorded from December to March. Several other unnamed species of *Lepidiota* were found, the life-histories of which are imperfectly known. *L. darwini* has been taken from *Eucalyptus*. Adults of *Isodon puncticollis* were found in February and March. *Dasygnathus australis* and *D. dejeani* are distributed throughout the cane and forest lands near Gordonvale, although in small numbers. The average length of the egg stage of *Cacochroa decorticata* is about 13 days. The life-cycle is completed in one year. The larvae occur more abundantly around the roots of *Imperata arundinacea* than in cane-fields. They are capable of living in dry soil for many weeks. Pupae have not been recorded in the field, but the duration of this stage, in captivity, was a month. The chief host trees are *Eucalyptus* sp. and *Melaleuca*. The life-cycle of *Xylotrupes australicus* lasts for more than a year. Pupae were obtained, in breeding cages, from November to February, the pupal stage lasting less than seven weeks. Adults may be found in large numbers on *Poinciana*. The larvae habitually feed on decomposing vegetable matter in the soil. *Calloodes grayanus* inhabits the almost pure sand of the river-bed at Gordonvale. A single pupa was found in October. Adults were captured from January to March. The known food-plants are *Melaleuca* and bloodwood (*Eucalyptus corymbosa & E. eximia*). The larvae of *Repsimus aeneus* have been recorded several times in cane-fields. *Anoplognathus boisduvali* occurs in the larval stage throughout the coast districts of Queensland in clay, black loam, or sandy loam, in forest, on various grasses and in cane-fields. The life-cycle occupies more than one year. Pupae were found at depths varying from 6 inches to 2 feet. Adults were obtained in canefields in October, November and December, and in the forest from October to March. The adults feed almost entirely on *Eucalyptus platyphylla*, which is often defoliated; *E. tereifolia* is sometimes attacked. *Anomala antiqua* (*australasiae*), *Pentodon australe*, *Mastochilus australasiae*, *Cladognathus torrensis*, *Neso planicollis*, *Liparetrus atriceps*, *Semanopterus depressiusculus* and *Horonotus optatus* were obtained in small numbers. Their life-histories are incompletely known.

GURNEY (W. B.). **Some Insect Pests of Apples and Pears.**—*Agric. Gaz. New South Wales, Sydney*, xxvi, part 4, pp. 303–312, 2 plates.

Thrips tabaci was very abundant during the spring and early summer of 1913–14, especially in the Bathurst district, where fruit blossoms were attacked. The insect first appeared in this district late in September and increased rapidly in numbers during the first week in October. From the fruit blossoms, the pest spread to garden flowers and tomatoes, serious damage, in some cases, being done to the crops. *Aspidiotus perniciosus* has been found on deciduous orchard trees. *Lepidosaphes ulmi* (*Mytilaspis pomorum*) occurred on apple and pear trees. The eggs hatch in October and November, when the blossoming is over. The adult stage is reached in from 2 to 3 months. There are generally two generations during the year. The larvae of the weevil, *Leptops hopei*, the apple root borer, attack the

roots of fruit trees; the adults are leaf and bud eaters and are sometimes a pest of grape vines. The eggs are laid at night on a leaf which is folded over by the female. The larvae, shortly after hatching, pass to the ground and begin to bore into the roots. Pupation takes place in the tunnels. The adults emerge from the ground and crawl on to the trees to oviposit. To reduce the number of adults, hand-picking may be resorted to. Arsenate of lead sprayed on to the foliage destroys a number of the beetles, as they feed on the leaves and buds. Trees which show infestation of the roots, must be uncovered and exposed larvae or pupae destroyed. *Eriocampoides limacina* (*Selandria cerasi*) and *Cacoecia postvittana* have been recorded on fruit trees. *Xyleborus solidus* is becoming a serious pest of apple, pear, plum, etc. The adult bores into trunk and branches, forming long cylindrical tunnels. The larvae feed on a fungus which develops in the tunnels. A repellent wash is made from soft soap, 1 pt. crude carbolic acid and 15–20 gals. water. *Bryobia praetiosa* (*pratensis*), *Eriophyes pyri*, *Cryptophaga* spp. and *Ceratitis capitata* have been recorded. The Lymantriid, *Teia anartoides*, occasionally attacks the foliage of cherry, apple, etc. The larvae can be controlled by lead arsenate spray. The Saturniid, *Antheraea eucalypti*, and the cotton-worm, *Prodenia litura* (*littoralis*), are also minor pests of apple foliage and can be controlled by means of lead arsenate or hand-picking.

Plants Protection Act, 1914.—*Bahamas Official Gaz., Nassau*, no. 15, 3rd April 1915, pp. 89–90. [Received from Colonial Office 10th May 1915.]

By the rules of this Act, all plants imported into the Bahamas must be landed at the port of Nassau, except when special permission has been obtained to land at some other place in the Colony, and must be delivered up to the Comptroller of Customs. If accompanied by a certificate stating that place of origin of the imported plants is free from disease, such plants may be delivered to the importer without undergoing fumigation or disinfection. If no certificate is forthcoming, the plants shall be examined by authorised persons, and will be destroyed or fumigated if necessary. All plants must be removed from the place of disinfection or fumigation within 24 hours after notification by the Board of Agriculture. Expenses of removal and of fumigation and disinfection shall be borne by the importer. Any importer of plants disinfected under these Rules, shall, if required, keep the Board informed as to the disposal of such plants.

Ehrhorn (E. M.). **Report of the Division of Entomology.**—*Hawaiian Forester and Agric., Honolulu*, xii, no. 4, April 1915, pp. 95–97.

During February 1915, 23 packages of fruit and five of vegetables were intercepted and destroyed. Many flowering bulbs were infested by *Pemphigus* sp. and were fumigated before delivery. Onions and garlic taken from a Filipino were found infested with the larvae of a Lepidopteron. Coconuts from Fanning Island were attacked by *Hemichionaspis minor*. Two colonies of the Australian Coccinellid, *Novius* (*Vedalia*) *cardinalis*, were reared and distributed in order to control a slight outbreak of the cottony cushion scale (*Icerya purchasi*).

The following parasites of the fruit fly and hornfly were liberated :— *Diachasma fullawayi* and *Tetrastichus giffardi* ; *D. tryoni* was reared, but not liberated.

VIERECK (H. L.). **Notes on the Life-History of a Species of Wasp-like Parasites of the Genus *Leptomastix*, parasitic on the Mealy Bug.**—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, no. 4, April 1915, pp. 208–211, 3 figs.

A new Chalcidoid parasite, a species of *Leptomastix*, found on *Pseudococcus citri* at Palermo, Sicily, in June 1914, was successfully removed to the State Insectary in California and reared on lemons infested with *P. citri*. The temperature varied from 50–105° F., the humidity being maintained by evaporating water in shallow pans over radiators and by means of moist moss in the cages. Specimens were transferred to lamp-chimney cages for investigation of the life-history. The life-cycle occupies from 41–63 days, the adults living from 20–34 days. Temperatures favourable for the increase of mealy bugs, increase the frequency of generations of the parasite. Oviposition takes place soon after emergence of the adult. Mealy bugs in the first or last stage are not attacked. The egg stage lasts from 3–6 days. Probably only one larva matures in a single mealy bug. The host retains the power of locomotion through the larval stage of the parasite, which lasts from 8–25 days, but dies as soon as the pupa is formed. The pupal period lasts from 10–18 days.

VOSLER (E. J.). **Calendar of Insect Pests.**—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, no. 4, April 1915, pp. 212–218, 3 figs.

The red-humped caterpillar (*Schizura concinna*) often causes serious damage to walnut, apple, prune, plum and cherry ,being most abundant from June to September. The larvae can be removed by hand-picking in the early stages, or by spraying with lead arsenate. Two species of cankerworms are found in the central and northern parts of the State, destroying the foliage of apples, cherries, apricots, etc. The grape leaf-hopper (*Typhlocyba comes*) is injurious in the Sacramento, San Joaquin and Imperial valleys. The first generation appears at the beginning of May and the second during the latter part of June. The grape-root worm (*Fidia viticida*) occurs throughout the northern and central parts from the end of April until June.

Insect Notes.—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, no. 4, April 1915, pp. 219–220.

Bryobia praetiosa (*pratensis*), the almond mite, is infesting almond trees near Santa Susanna. *Tetranychus mytilaspidis* is present in citrus grove in Ventura county and in pear orchards near Sacramento. *Eriophyes pyri*, the pear-leaf blister mite, has been observed during March in Nevada, beneath the bud scales, where were also many eggs. Probably the mites spend the winter in this position, ovipositing as the buds begin to swell, and the first mites to do any damage are those that have emerged from the eggs laid by the hibernating individuals.

The larvae of wire-worms have been injurious to newly planted potatoes and other root crops near Sacramento during March. The Chrysomelids, *Haltica bimarginata*, Say, and *Disonycha quinquevittata*, Say, were collected on willow in March in Yolo county. Adults of *Eriocampoides limacina* (*Caliroa cerasi*), the pear slug, were taken on pear trees near San Jose on 25th March. *Hippodamia convergens* has been introduced into the Imperial Valley for use against the melon aphis (*Aphis gossypii*). Adults of *Tipula simplex* were common during the middle of March in Sacramento county. A number of larvae and one pupa of *Cydia pomonella* were found beneath the bark of apple trees on 11th March, while the trees were still practically dormant. *Pseudococcus* sp. was found in certain vineyards in Fresno county early in March. This species, which caused considerable damage during the past season, passes the early part of the year under the bark of the vine, thus rendering control by spraying of little use. *Cacoecia* (*Archips*) *argyrospila*, the fruit-tree leaf-roller, is doing considerable damage to pear buds. Twigs infested with the San Jose scale (*Aspidiotus perniciosus*) have been received from a locality in which a parasite of the scale, *Prospaltella perniciosi*, was abundant last year. *Pseudococcus bakeri* was taken from apple trees in Yolo county. Colonies of *Leptomastix* sp., a new Chalcidoid parasite of the mealy bug, have been liberated at Alhambra, San Francisco, Ventura, etc. *Tæniothrips pyri* has been found in the Sacramento River pear section. Spraying with standard distillate oil emulsion, Black Leaf 40 formula, is being carried on. The grain thrips, *Frankliniella* (*Euthrips*) *tritici*, has been reported on young apricots. *Aspidiotus hederae*, the ivy scale, has been a serious pest of lemons and oranges in San Diego during the past season. Injury is mainly caused by the insect feeding on the fruit. *Eriosoma lanigerum* was common near Grass Valley on 11th March. A number of pear trees were undersized and, in many cases, foliage during the previous season had dropped early, owing to infestation of the roots. A Dipterous leaf-miner, probably a Cecidomyid, was recently found on boxwood in a greenhouse at Fresno. The plants were said to have been imported from England.

MASKEW (F.). **Quarantine Division; Report for the Month of February 1915.**—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, no. 4, April 1915, pp. 221–222.

The following pests have been intercepted :—Weevil larvae in sweet potatoes ; *Chionaspis citri*, *Pseudaonidia trilobitiformis*, *Chrysomphalus aonidum*, *Lepidosaphes beckii*, *Parlatoria pergandii*, *Parlatoria ziziphus* and *Phomopsis citri* on pomelos ; *Lepidosaphes uimi* on boxwood ; *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples ; *Coccus longulus* on betel leaves ; *Pseudococcus* sp. on sisal plants ; *Aleurodes* sp. on Camellia ; *Agromyza websteri* on wistaria ; Lepidopterous pupae and the Arachnid, *Poliaspis pini*, on pine trees ; *Aulacaspis pentagona* on cherry tree ; *Lepidosaphes gloveri* on limes ; *Heterodera radicicola* in potatoes ; *Aspidiotus cydoniae* on bananas ; larvae of *Dacus cucurbitae* in watermelons ; larvae of TRYPETIDAE in papaya ; *Aphis persicae-niger* and *Aspidiotus perniciosus* on peach trees ; *Aulacaspis rosae* on rose ; *Cerataphis lataniae* and *Chrysomphalus*

aurantii on palms; *Parlatoria pergandii* on oranges; *Selenaspidus articulatus* on *Cycas circinalis* and *Cocos nucifera*; *Asterolecanium* sp. on *Guacamaya francesca*; crown-gall and root-knot on deciduous plants.

STONER (D.). **Two Beetles reared from dead Wistaria Sticks.**—*Entom. News, Philadelphia*, xxvi, no. 3, March 1915, pp, 126-127.

Chrysobothris azurea and *Lepturges querci*, both wood-boring species, were found in dead branches of *Wistaria chinensis* at Iowa on the 28th May 1914. Adult males and females emerged between 29th May and 10th June. The large numbers of *L. querci* indicated a high degree of infestation.

HUNGERFORD (H. B.). **A Parasite of the Cottonwood Borer Beetle (Col., Dip.)**—*Entom. News, Philadelphia*, xxvi, no. 3, March 1915, p. 135.

While studying the effect of poisoned bait on grasshoppers in western Kansas in 1913, large numbers of dead cottonwood borer beetles (*Plectodera scalator*) were observed. Investigation showed that death was not due to poisoning, but to the presence of a parasite, *Sarcophaga vericauda*, a species which has hitherto only been reared from grasshoppers.

La diffusion du phylloxéra en Italie. [The spread of *Phylloxera* in Italy.]—*Bull. bi-mens. Off. Gouv. Gén. Algérie, Paris*, xxi, no. 4, 1st–15th April 1915, p. 62.

According to the *Bolletino del Ministero di Agricoltura*, 3,228 communes in Italy were either infested with *Phylloxera* or supposed to be so, on the 31st December 1914; 3,747 communes were free from infestation.

DEGRULLY (L.). **Préparation des Bouillies cupriques.** [The preparation of copper sprays.]—*Progrès Agric. Vitic., Montpellier*, lxiii (32nd year), no. 17, 25th April 1915, pp. 387–392.

Like acid solutions of copper, ammoniacal ones have the property of keeping part of the copper in solution and immediately active. Such a formula is that of "eau céleste" (Audoynaud process), which contains 1 lb. of copper sulphate, 0·120 pints of 22° ammonia and 10 gals. of water. Phenolphtaleine is usually employed for testing neutral Bordeaux mixture. The paper is easily prepared by dissolving 1½ grms. of phenolphtaleine in 50 grms. of 90° alcohol; white blotting paper or filter paper is dipped in this solution for a few minutes and then dried in the sun. If protected from damp, this paper keeps for several years in good condition.

L'impiego degli insetticidi arsenicali e i suoi pericoli igienici. [The use of arsenical insecticides and their danger to health.]—*Minerva Agraria, Milan*, vii, no. 5–7, 15th–31st March & 15th April 1915, p. 93. [Translated from the *Arb. a. d. Kais. Gesundheitsamte, Berlin*, xxix, 1915, p. 11.]

The use of arsenical sprays may prove a danger to health. Fruit trees were sprayed with Bordeaux mixture and with a solution containing Paris green. An examination made 40 to 50 days after a single application of Bordeaux mixture, showed an appreciable amount of arsenic on currants and gooseberries. This was also the case with apples and pears examined 87 days after two applications had been made. The leaf-tissues behave in the same way as regards the absorption of arsenic, while leaves and fruit examined in order to ascertain their lead content, also gave similar results. Paris green solutions behaved in practically the same manner.

Esperienze de lotto contro le tignuole dell' uva nel Württemberg. [Experiments in vine-moth control in Wurtemberg.]—*Minerva Agraria, Milan*, vii, no. 5–7, 15th–31st March & 15th April 1915, pp. 94–95. [Translated from the *Zeitschr. für Weinbau u. Weinbehandlung, Berlin*, no. 2, 1915.]

According to Dr. R. Meissner, of the Weinsberg Agricultural Experiment Station, in Wurtemberg, the best results against vine-moth [*Clysia ambiguella* and *Polychrosis botrana*] are given by a $1\frac{1}{2}$ per cent. solution of nicotine. This did not cause any scorching in 1914, in which year the tests were made.

Schneider-Orelli (O.). **Zur Schildlausbekämpfung an Johannisbeer- und Stachelbeersträuchern.** [The control of scale-insects on currant and gooseberry bushes.]—*Schweiz. Zeitschr. für Obst- und Weinbau, Frauenfeld*, xxiv, no. 7, 8th April 1915, pp. 98–100.

The control of *Eulecanium* (*Lecanium*) *corni* (*vini*) on currant and gooseberry bushes may be easily and cheaply effected by spraying towards the end of March or at the beginning of April with a 3 per cent. solution of soft soap. Complete destruction of the scale necessitates several applications during the spring.

Lesne (P.). **Les insectes nuisibles aux arbres fruitiers.** [Insect pests of fruit trees.]—*Jl. d'Agric. pratique, Paris*, xxviii, nos. 41 & 42, 1st & 8th April 1915, pp. 312–314 & 327–328, 1 plate.

Insects injurious to the leaves of fruit trees in France are briefly described, and include *Tortrix xylosteana*, L., *T. cerasana*, Hbn., *Oxygrapha* (*Teras*) *contaminata*, Hbn., *O. holmiana*, L., *Olethreutes* (*Penthina*) *pruniana*, Hbn., *Eucosma tripunctana*, Schiff., (*ocellana*, Hbn.), *Hemerophila* (*Simaethis*) *pariana*, Cl., *Hyponomeuta malinellus*, Zell., *H. padellus*, Hbn., *Leucoptera* (*Cemiostoma*) *scitella*, Zell., the Cecidomyid. *Perrisia pyri*, Bché., and the mite, *Eriophyes pyri*, Pag.

NOTICES.

The Editor will be glad to receive prompt information as to the appearance of new pests, or of known pests in districts which have hitherto been free from them, and will welcome any suggestion the adoption of which would increase the usefulness of the Review.

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CATONI (C.). **Le tignuole dell' uva ed i loro nemici naturali nel Tirolo del Sud.** [Vine-moths and their natural enemies in South Tyrol.] —*Riv. Vitic. Enol. Agrar., Conegliano*, xxi, nos. 7 & 8, 1st & 15th April 1915, pp. 156-160 & 177-181. [Translated from *Zeitschr. Angewandte Entomologie, Berlin*, i, no. 2, 1914, p. 248.]

The author, who has strongly advocated the use of rag shelter-traps in the control of *Clysia ambiguella* and *Polychrosis botrana*, gives tables showing how greatly parasitised the chrysalids taken from the shelters often prove to be in certain years, which are then followed by a diminished infestation. In the Trentino region, where these observations were made during a period of ten years, the following parasites of *P. botrana*, the dominant species, were found :- Chalcids : *Habrocytus punctiger*, *Microplitis tuberculifera*, *Monodontomerus obsoletus* and *Trichogramma* (*Pentarthron*) *semblidis*. Hyperparasitic Chalcids : *Cricellius decipiens*, *Dibrachys boucheanus*, *D. affinis*, *Eurytoma rosae* and *Habrocytus acutigena*. Ichneumonids :- *Angitia tenuipes*, *Cinxaelotus erythrogaster*, *Dicaelotus resplendens*, *Exochus tibialis*, *Gambrus inferus*, *Habrocryptus alternator*, *Habrocryptus punctiger*, *Hemiteles hemipterus*, *Hemiteles sordipes*, *Herpestomus furunculus*, *Microcryptus nigrocinctus*, *Omorgus difformis*, *Phaeogenes* sp., *Pimpla alternans*, *P. detrita*, *P. examinator*, *P. maculator*, *P. strigipleuris* and *P. turionellae*. Hyperparasitic Ichneumons : *Hemiteles areator* and *Pezomachus sericeus*. The Tachinid, *Phytomyptera nitidiventris*, was the only dipterous parasite observed. The number of vine-moth pupae varied from 3 to 10 per stock, the percentage of healthy ones varying from 21 to 50. The fungi, *Botrytis bassiana*, *Botrytis tenella*, *Cladosporium aphidis*, *Isaria* spp. and others also attacked larvae and pupae. The percentage of fungus parasitation varied from 2·7 to 11·1. The fact that the parasites appear before the vine-moths, suggests that they oviposit in intermediate hosts and that the resulting first generation of parasites is followed by a second one which attacks the moths. As the intermediate hosts must live on plants other than the vine, the presence or vicinity of such plants must influence the number of parasites. The paper also contains important data concerning the date of maximum flight of the vine-moths in the various years in which observations were made. If a study of this character were carried out in every infested district, the problem of vine-moth control would be greatly advanced.

LUNARDONI (A.). **The Control of Locusts in Italy.**—*Mthly. Bull. Agric. Intell. Plant Dis., Rome*, vi, no. 4, April 1915, pp. 522–532, 6 figs.

The regions of Italy in which locusts appear with a certain frequency are : Sicily, Sardinia, Calabria, Basilicata, Apulia and Latium. They occur, though much less frequently, in Tuscany and Venetia and the districts of Crema and Lodi. The outbreaks are not *invasions* from Africa, but are due to locusts that are hatched and multiply, unnoticed for several years, in Italy itself. *Dociostaurus* (*Stauronotus*) *maroccanus* is the predominant species, *Calliptamus italicus*, L. (the Italian locust) being in a very small proportion. Together with these Acridiids, but only in Southern Italy, *Tettigonia* (*Decticus*) *albifrons*, Serv., is more or

less frequently found. Contrary to the opinion that locust outbreaks in Italy last two or three years and then disappear of their own accord, these locusts may continue to multiply for many years without difficulty and their almost total disappearance, if not due to the action of man, cannot occur except through that of *Empusa* (*Entomophthora*) *grylli*, which is much less frequent, if not very rare, in the southern provinces. Not one case of mycosis was found during three successive campaigns against locusts in Sicily. If the system of using arsenites of soda and lead to poison the grass be set aside on the score of danger, the only remaining efficient means of controlling locusts are: (1) The use of flames of burning petroleum mixed with benzine; (2) spraying the locusts with contact washes; (3) capturing them with sheets and collectors; (4) collection and destruction of the egg-masses. The petroleum flame should always be adopted where petroleum is cheap, or where the infestations are numerous, severe and threatening in the vicinity of sown fields, or where it is not possible to have sufficient quantities of insecticide washes at hand. A number of sprayers suitable for flame work are described. Almost any nozzle is good which produces a large mist of fine petroleum spray. The addition of 10 per cent. of benzine makes perfect combustion easy. The men must be quick and intelligent and must work with the wind behind them if accidents are to be avoided. The costliness of this method in Italy (the mixture costs about 1s. 10d. a gallon) prompted practical experiments in the comparison of the efficiency and relative cost of various insecticides to be carried out in April 1914. Of the liquids tried, an emulsion of tar-oil-soap yielded the best technical and economical results and is the one described here. It kills the grasses, but the meagre pasture would have met with the same fate from the locusts and a portion was sacrificed in order to save the sown crops. To prepare this emulsion in the field, the author used cylindrical sheet-iron boilers, 26 inches high and 22 inches in diameter and fitted with handles. Into each, $14\frac{1}{2}$ gals. of water was poured and the boiler was put on a fire; when the water was warm, $13\frac{1}{5}$ lb. of yellow emulsive potash soap was added and well mixed with a stick. When the soap and water began to boil, $6\frac{3}{5}$ gals. of heavy tar-oil was added, a little at a time, with continuous stirring and allowed to boil for about 10 minutes. The emulsion was then poured into an open cask; it contains 30 per cent. of heavy tar-oil and 6 per cent. of soft soap. If fuel costs as much as 1s. 6d. per cwt., a certain saving can be effected by boiling 22 gals. of water with 20 lb. of soft soap and then pouring the liquid into a vat containing 100 lb. of heavy tar-oil and stirring until a uniform mixture is obtained. This emulsion does not keep so well as the boiled one, but is equally efficient if used on the same or the next day. In exceptional cases, the emulsion can be prepared without heat, but does not seem to be so effective or so stable. With the idea of retarding the evaporation of the emulsion sprayed on the locusts exposed to the burning sun and wind—the author added 1 or 2 per cent. of common salt to the emulsion and found that its action was thereby increased. For use, the concentrated emulsion was diluted as follows: To each petroleum tin (a convenient unit for field work) of emulsion, 5 of water were added when the locusts were in the first larval stage, 4 when they were somewhat larger, 3 when they reached the nymph stage, 2 when their wings began to appear and $1\frac{1}{2}$

or even I later, or when spraying was done at night. The deadly action of the emulsion is attributed to the phenols and cresols contained in the heavy tar-oil, which have a reducing action and penetrate into the spiracles of the locusts. The effect is deadlier and more rapid in proportion to the violence and suddenness of the spray, from which the author believes that the locusts keep their spiracles open when at rest and close them on being disturbed. Dr. Alfredo Parozzani believes that besides carbolic acid and its analogues, other bodies existing in the tar-oil, such as naphthols, pyridine bases, etc., act upon the locusts. The soap renders the body of the insect more sensible to the caustic action of the emulsion. Portable sprayers were used and as rubber hose swells and cracks, oil-cloth hose is required. This new system does not present any danger; it is as efficient as the petroleum flame, perhaps more so, and costs less than any other means of control; for while with 22 gals. of benzine-petroleum, costing about £2, 2,770 to 3,770 square feet of ground covered with locusts can be burned, the same quantity of emulsion for locusts in their first stages costs only about 2s. 2d. and will spray 2,150 to 3,220 feet. The emulsions used later, cost respectively 2s. 8d.; 3s. 2d.; 3s. 7d.; and 4s. 4d. per 22 gals. As the locust eggs deposited in one locality do not all hatch at once (sometimes at considerable intervals, if the weather be unfavourable) the necessity of revisiting, and perhaps of treating again the areas which have already been scorched or sprayed, is apparent. To avoid this, the soil, if not stony or hard, may be hoed to a depth of a couple of inches and the loosened soil collected in heaps and every layer rammed with a heavy rammer; only a few of the egg-masses will escape destruction and hatch out. Night work by artificial light gave very good results with the emulsion. Sheets are very effective in collecting locusts and a useful modification of them is described. This collector consists of a zinc hopper carried on a light vertical frame to the base of which is fixed a horizontal frame laid on the ground. A sheet is stretched between two rollers, one being at the top edge of the vertical frame and the other at the free front edge of the horizontal frame on the ground. The locusts which get on to the inclined sheet, fall into the hopper, when the latter is wound up. The collection of egg-masses is recommended as an additional means of control where infestation is severe. From 26th October 1913 to 30th March 1914, nearly 100 tons of locusts' eggs were collected under the author's direction. They represented 6,500 millions of insects and the total cost was £1,240, an average of 1·38*d.* per lb., containing about 29,000 eggs. Collection costing over $2\frac{1}{2}$*d.* per lb. will probably not pay. According to experiments, which, on account of their nature, cannot always yield the same figures, the destruction of 1,000,000 locusts costs from 12*s.* 6*d.* to 25*s.* when petroleum is used; 16*s.* to 32*s.* with the sheets and 1*s.* 8*d.* to 5*s.* 10*d.* with the emulsion. Picking the eggs may cost from 1*s.* 2*d.* to 25*s.* and upwards per 1,000,000. It is estimated that from 16th April to 11th July 1914, in Catania, about 1,185 acres of land covered with locusts were sprayed with emulsion, about 880,000 lb. of locusts, of all sizes, being destroyed. With the sheets, 198,000 lb. of locusts in the nymph and winged stages were collected. From these approximate calculations, it is estimated that about 12,000 million locusts were destroyed at a cost of £1,440.

Nowell (W.). **Two Scoliid Parasites on Scarabaeid Larvae in Barbados.** —*Ann. App. Biol., London,* ii, no. 1, May 1915, pp. 46–57, 1 fig., 1 plate.

Two of the Lamellicorn beetles which occur in Barbados, are the Dynastid, *Ligyrus tumulosus*, Burm., and the Melolonthid, *Phytalus smithi*, Arrow. The latter is parasitised by the Scoliid wasp, *Tiphia parallela*, Smith, and the former by another Scoliid, *Campsomeris* (*Dielis*) *dorsata*, F. A description is given of the method by which *Tiphia* was introduced into Mauritius where *P. smithi*, which had probably been imported from Barbados, is now causing great damage over an ever-increasing area. [See this *Review* Ser. A, i., p. 28.]

Dry (F. W.). **An Attempt to Measure the Local and Seasonal Abundance of the Swede Midge in Parts of Yorkshire over the years 1912 to 1914.**—*Ann. App. Biol., London,* ii, no. 1, May 1915, pp. 81–108, 2 figs., 5 charts, 1 plate.

This paper describes a census of *Contarinia* (*Diplosis*) *nasturtii*, Kieff. (the swede midge), made during the years 1912 to 1914 in the East and West Ridings of Yorkshire. The life-history of the swede midge and the distortion which it causes to the swede plant are briefly described from T. H. Taylor's "Cabbage-Top in Swedes." The flies are first found in the swede fields in June. The eggs are laid in strings and clusters mostly near the base of the leaf-stalks, but some on the leaf-blades; the younger leaves are almost the only ones to be attacked. The eggs hatch in about four days and the maggots feed on the superficial tissues. The larval stage lasts about three weeks. When full grown, the maggots enter the soil and the flies emerge, in the case of the summer broods, in from two to three weeks. The normal number of broods for the season appears to be three, although in the hot summer of 1911 there were four broods. The winter is spent in the soil. The distortion to the plant caused by the maggots is described, and, according to Taylor, this pest is one cause of the condition in which the plant has several necks or main shoots instead of a single one. Besides swedes, the following plants have been found to be attacked: *Brassica napus* (turnip), *B. rapa* (rape), *B. oleracea* (cabbage), *B. sinapis* (charlock or wild mustard), *Raphanus sativus* (radish), *R. raphanistrum* (wild radish). Turnips are only attacked to a very slight extent. In May-sown fields, the attack was more severe than in June-sown ones and coast districts were less infested than inland ones. This midge appears to be very largely influenced by weather. An Empid fly which preys upon the midge was common at Garforth (West Riding) in June 1914; some individuals are also accounted for by small spiders. In September 1914, a number of Proctotrupid parasites were reared from the larvae.

Horne (A. S.). **The Occurrence of Fungi on** *Aleurodes vaporariorum* **in Britain.**—*Ann. App. Biol., London,* ii, no. 1, May 1915, pp. 109–111.

In December 1914, a considerable quantity of fungus was noticed on the leaves of *Centropogon*, at Wisley, which was badly infested, for experimental purposes, with the nymphs of *Aleurodes vaporariorum*

(whitefly). The under surface of the leaves, infested with a quantity of eggs, nymphs and a few emerging and complete imagines, was covered with mycelial tufts of *Cladosporium* and wefts of *Cephalosporium*. The mode of occurrence on the *Aleurodes* nymph of this *Cephalosporium*, which has been named *C. lefroyi*, agrees in every respect with Parkin's description and figure of *C. lecanii* on *Lecanium*.

THEOBALD (F. V.). **Notes on a Lime Tree Aphis,** *Pachypappa reaumuri*, **Kaltenbach, new to Britain.** *Entomologist, London*, xlviii, nos. 623 and 624, April and May 1915, pp. 73–76 and 116–119, 6 figs., 2 plates.

Pachypappa reaumuri was found on a broad-leafed lime tree at Bearsted, Kent, in June 1914. The tops of the shoots with the smaller leaves were in most cases rolled up inside one of the larger leaves and the stems were markedly bent over just below the gall. Later the whole leaf mass died, owing to the constant sucking of the insects within. The viviparous females kept under observation dropped their young on the soil. While still small, these crawled into the ground and were afterwards found attached to the roots of grass and primroses growing in the breeding cage. This aphid leaves the lime in June, and, according to Del Guercio's observations in Florence, returns to it in September. At Bearsted, the species was attended by ants (*Lasius fuliginosus*). A description of each of the stages is given.

JENNINGS (F. B.). **On the Food-plants of some British Weevils.**—*Entomologist's Mthly. Mag., London*, no. 612, May 1915, pp. 167–170.

Cneorrhinus (*Philopedon*) *plagiatus*, Schall., has been recorded on broom, marram-grass and vine. Everts, referring to it as a Dutch species, states that the larvae and pupae have been found at the base of sand-dune grasses and on firs. In the latter case, young trees are chiefly attacked, the beetles feeding on the needles, cones and terminal shoots. Feeding takes place during early morning and evening, while during the day the insects usually hide in the ground.

EDWARDS (F. A.). **Gas Tar Treatment for Mealy Bug.** *Gardeners' Chronicle, London*, lvii, no. 1481, 15th May 1915, p. 266.

In treating vines for mealy bug (*Pseudococcus*), all loose bark is first removed from the bases of spurs around the eyes. The glass and woodwork of the vinery is disinfected with paraffin solution and hot lime. Loose soil from the vine borders should be removed and replaced by fresh loam. The previous season's wood of the vine is then painted with a mixture of clay (1 part), water (3 parts) and gas tar (1 part), the mixture having been previously boiled for a few minutes and allowed to cool. The eyes should be carefully avoided during the operation.

Warren (W. H.). **Gooseberry and Currant Sawfly.**—*Gardeners' Chronicle, London*, lvii, no. 1482, 22nd May 1915, p. 277.

Pteronus ribesii appears in April or May; the eggs are laid on the under side of the leaf near the largest veins. A light dressing of well-seasoned gas-lime over the surface of the soil in early spring is a good preventive. When the larvae are detected on the bushes, hand-picking, shaking them on to waterproof sheets laid beneath the bushes, or spraying with hot water should be resorted to. Syringing with poisonous insecticides is not recommended when fruits are present: a mixture consisting of 3 gals. warm water, ½ lb. soft soap and the same quantity of soot may be safely sprayed on to the bushes on a dull day. The bushes should be syringed about an hour later with clean water.

Hardy (E. G.). **Division of Botany, Annual Report 1913-14.**—*Rept. Union of South Africa Dept. Agric. for the year 1913–14, Capetown*, 1915, pp. 147–158. [Received 22nd May 1915.]

During the year the cultivation of the bagworm fungus has been carried on, and over a thousand cultures were distributed among the wattle-growers in Natal. The results, however, have not been satisfactory, owing to the dry season. It has been observed that bagworms infesting plantations have been decimated by an infection which is supposed to be bacterial, though several bacteria isolated from dead worms have not proved pathogenic to healthy ones.

Simmons (C. A.). **Report of the Government Fruit Inspector.**—*Rept. Union of South Africa Dept. Agric. for the year 1913–14, Capetown*, 1915, pp. 177–184. [Received 22nd May 1915.]

The following insect pests have been noticed at the Experimental Station :—Californian red scale (*Chrysomphalus aurantii*) and Florida red scale (*Chrysomphalus aonidum*) on citrus trees; oleander scale (*Aspidiotus hederae*) on olives; greedy scale (*Aspidiotus rapax*) on apples and pears; olive bug (*Teleonemia australis*) on olives; fruit fly (*Ceratitis capitata*) on all stone fruits, olives and loquats; and orange codling moth (*Argyroploce leucotreta*) on citrus. The last-named pest was effectively controlled by means of the Mally remedy.

Lounsbury (C. P.). **Division of Entomology: Annual Report 1913-14.**—*Rept. Union of South Africa Dept. Agric. for the year 1913–14, Capetown*, 1915, pp. 199–216. [Received 22nd May 1915.]

The work of the Division has included the suppression of locusts, inspection of nurseries and of plant and fruit imports, and restrictions on the conveyance of fruit and plants. The chief pests found in vine nurseries were *Heterodera* (root gallworm), *Phylloxera* and red scale. *Aspidiotus perniciosus* was found in one nursery in Pretoria. Quarantine was imposed on 31 nurseries on account of the presence of *Chrysomphalus aurantii*, *C. aonidum*, *C. rossi*, *Lepidosaphes beckii*, *Eriosoma* (*Schizoneura*) *lanigerum* and *Eriococcus araucariae*. *Trioza* sp., *Aphis*

persicae, *Phylloxera corticalis*, and the Psyllids, *Rhinocola eucalypti* and *R. dianthi*, have been recorded. No changes have been made in connection with plant and fruit import regulations. An area in the midlands of the Cape Province was overrun by migratory locusts in the spring and summer of 1913–14. The species concerned was probably *Locusta pardalina*. Hatching began early in October and continued for several weeks. In addition to such control measures as spraying and the use of poisoned bait, an effort was made to utilise *Coccobacillus acridiorum*. The success of this measure was not apparent. Winged locusts were observed in November and migrated into the Transvaal, Basutoland and Natal. A second generation appeared early in February in the Hofmeyr, Middelburg, Steynsburg and Molteno districts. The South African Central Locust Bureau has received reports from the different territories as to the presence or absence of locusts in 1913–14. Basutoland reported the entrance of a swarm, and mentioned that the insects were collected by natives at night and the extermination of the swarm is attributed to this action. Winged swarms of *Schistocerca peregrina* were reported from German East Africa in November and December 1913. The flight was from the mountains towards the plains. In February 1914 a new breeding place was reported in the districts of Kondoa-Irangi and Dodoma.

Progress has been made in the investigations of *Busseola* (*Sesamia*) *fusca* (maize stalk borer), the beetles, *Heteronychus arator* and *Phoracantha recurva*, and a tree cricket. Measures for the suppression of the Argentine ant, the mealy-bug and the house-fly have received attention. *Muscidifurax vorax*, a parasite of the house-fly, has been discovered. Living material of *Coccus indicus*, which destroys *Opuntia monocantha*, has been received.

FROGGATT (W. W.). **A descriptive Catalogue of the Scale Insects of Australia.**—*Agric. Gaz. of New South Wales, Sydney*, xxvi, 5th May 1915, pp. 411–423, plates 8–11.

The paper gives an account of the sub-family LECANIINAE, which is represented by many native species and by most of the cosmopolitan genera which have been accidentally introduced with their food-plants and are now well established in orchards and gardens. *Ceronema banksiae* occurs on the leaves of *Banksia serrata*. *C. caudata* has been found on the foliage of *Eucalyptus robusta* and *C. dryandrae* on *Dryandra floribunda* and *D. nivea*. *Pulvinaria contexta* and *P. darwiniensis* feed on *Bossiaea* sp. and *Caladium* sp. respectively. *P. flocciferа* occurs on many garden shrubs, such as *Camellia*, *Euonymus*, *Brassia*, *Phaius*, etc.; it is a common hothouse scale in England and France, appearing on the underside of the leaves. *P. maskelli* is common on *Atriplex* sp. and *Rhagodia* sp., fodder plants widely grown in Australia. *P. nuytsiae* and *P. greeni* have been found on *Nuytsia floribunda* and *Myoporum deserti* respectively. *P. tecta* is a common pest on *Kunzea capitata* and *Daviesia* sp. *P. theae* has been found on the leaves of *Thea viridis*. *Ceroplastes ceriferus* (Indian wax scale), introduced with ornamental shrubs, has spread from garden plants into orchard and waste land; *Bursaria spinifera* and citrus trees are generally attacked. *C. rubens* (red wax scale) is common on tea, mango, palms, fig, ivy, etc., and has been recorded on plum, pear and orange.

Pea and Bean Weevils.—*Agric. News, Barbados*, xiv, no. 340, 8th May 1915, p. 154, 1 fig.

Peas and beans are subject to the attack of beetles of the genus *Bruchus*. The eggs are laid in the flower or on the very young pod. The larva on hatching, bores into the young seed, rendering it unfit for food or planting. The remedy is to plant only seed which is free from beetles, and to destroy insects in stored seed, which may be fumigated with carbon bisulphide. The Hesperid, *Eudamus proteus*, the bean leaf-roller, and the Noctuid, *Anticarsia* (*Thermesia*) *gemmatalis*, can be controlled by the application of dry lead arsenate, either alone or mixed with lime. Paris green cannot be used on account of its destructive effect on the leaves.

H. A. B. **Cassava Stem Borer.**—*Agric. News, Barbados*, xiv, no. 340, 8th May 1915, p. 155, 2 figs.

A species of *Cryptorhynchus* has been reported on cassava, causing considerable injury to the stem. The borer is little known, so that there has been no opportunity of testing methods for its control. It is suggested that material for planting should be quite free from infestation, and all waste material from infested fields should be burned or deeply buried to kill the larvae or adult weevils.

Richards (P. B.). **A Note on Sulphur-Arsenic Mixtures for fumigating** ***Termes gestroi*****.**—*Agric. Bull. Fed. Malay States, Kuala Lumpur*, iii, nos. 6–7, March-April 1915, pp. 225–229.

The method of treating termites with sulphur-arsenic fumes has recently fallen into disuse. Lack of success with the fumigator may be attributed to insufficient organisation, badly kept apparatus and incorrect methods of preparation of the arsenic and sulphur mixture. The underlying principle of the "Universal" Exterminator, a compound no longer procurable, is the formation of arsenious sulphide from a strongly heated mixture of sulphur and white arsenic. The sulphide is prepared by placing a quantity of the mixture on a charcoal fire in a retort, the heat being maintained under a forced draught from a pump which serves also to drive the fumes out through a nozzle. The latter is inserted into the nest and the fumes are forced in for from 5 to 15 minutes. By this means, a quantity of white arsenic is volatilised and driven into the nest; sulphur dioxide, carbon bisulphide, realgar ($As\ S_2$), carbon monoxide and carbon dioxide may also be present. The length of the ramifications of the nest prevent complete asphyxiation of the ants by these gases. The arsenic is required to poison individuals which escape suffocation and to cover the fungus gardens from which the young are fed, the bodies of suffocated insects and the walls of the nest with a poisonous layer. The dead insects are eaten, and thus more individuals are killed, while the food supply of the young is poisoned. It is important to maintain a high-pressure throughout the operation. The mixture should consist of 87·5 per cent. by weight of arsenious oxide and 12·5 per cent. of sulphur. The latter should be in the form of flowers of sulphur or finely ground sulphur, and the mixture should be as intimate as possible.

RICHARDS (P. B.). **Methods and Materials for the Control of Insect Pests. (Part 4.)**—*Agric. Bull. Fed. Malay States, Kuala Lumpur,* iii, nos. 6–7, March-April 1915, pp. 237–241.

Nicotine is obtainable in the form of tobacco extract, which is prepared on a large scale by treating coarse tobacco leaves with hot water and distilling the solution obtained. In France the extract is largely used for combating vine pests. In America "Blackleaf 40" contains 40 per cent. of nicotine sulphate; "Nico-fume" contains 40 per cent. of free nicotine, and "Blackleaf" Extract from 2–3 per cent. nicotine. The spray is useful for small insects and mites, but is too expensive except for valuable crops. *Nicotiana rustica* contains 4–5 per cent. of nicotine in the dried leaf. To make the wash, the leaves should be broken up finely and extracted in three successive lots of water at the rate of 1 gal. to 1 lb. of leaves. The tobacco should be steeped for 24 hours in each lot of water and the temperature should not exceed 140° F. The stems and leaf-veins are first crushed, then soaked in water at the rate of 1 gal. to 5 lb. The extract so obtained contains about 0·12 per cent. of nicotine. Tobacco extract is rendered more effective by the addition of soap at the rate of 2 to 4 lb. to 100 gals. of the wash. Hops will stand spraying with 0·08 per cent. solution, at which strength rose shoots are injured. A strength of 0·025 per cent. will kill aphids and thrips. For bug nymphs and scale-insects, the addition of soap is necessary. Hellebore spray is obtained from the roots of *Veratrum viride* and *V. album*, *Helleborus niger* and *H. foetidus*. From 5 to 7½ lb. of finely powdered root are stirred up in 100 gals. water. When used as a dusting powder, the root is mixed with three times its weight of flour, gypsum or wood ash. The use of *Veratrum album* and *V. viride* is recommended for ripening fruit, since the poisonous properties disappear in 3–4 days. Quassia spray is obtained by exhausting quassia chips with hot water.

STOREY (G. A.). **Notes on Large Scale Experiments against the Pink Boll Worm in Cotton Seed.**—*Agric. Jl. Egypt, Cairo,* iv, no. 2, (1914) 1915, pp. 115–124, 2 plans. [Received 30th June 1915.]

The hot air treatment and fumigation methods previously recommended for trial [see this *Review*, Ser. A, ii, p. 218] have been tested on a large scale. A full description is given of the hot air machine, which was a double-walled wooden box 13 feet long, 2 feet high, and 2 feet broad, heated by steam pipes. In this the cotton seed was passed on an endless canvas band. The results are set out in a table. It was found that with this particular machine treatment of the seed (i) for 3½ minutes at temperatures between 159° and 177° F., (ii) for 6½ minutes between 140° and 159° F., and (iii) for 10½ minutes at 140° F., succeeded in killing all the larvae without injuring germination. Three and a half minutes at temperatures of 177° and 195° F. does not injure the seed much, if at all. The running conditions most suitable for this particular machine are undoubtedly 3½ minutes at 167° F. Longer times are inadvisable owing to the immense size of the machine which would be necessary

to deal with a reasonable amount of seed in a limited amount of time. With shorter periods the temperature is too high to be controlled with ease and certainty. The importance of thoroughly testing every single machine cannot be too strongly emphasised. Another set of experiments tested the effect of varying the amount of seed passed through the machine. The results are tabulated and show that in no single case were all the caterpillars killed, although when a thin layer was exposed to exactly similar conditions not a single larva survived. This emphasises the fact that it is not the temperature recorded by the thermometer which matters, but the actual temperature reached by each individual seed. The disadvantage of a machine of this type from the commercial point of view is the enormous size which will be necessary if it is to deal with seed at the rate at which it comes from the gins. The above machine had an internal capacity of over 40 cubic feet and was only able to deal with 1 ardeb [5·447 bushels] in about 5 hours, an alarmingly slow rate. An apparatus for the fumigation of cotton seed has been built by Messrs. Thos. Cook & Son at their Bulâk workshops on the lines indicated previously. Six vats, each with a capacity of about 40 cubic feet (*i.e.*, about 27 bushels of cotton seed), form the body of the plant, and the rest of the apparatus consists of the system of tubes, the pump and the carburetter in which carbon bisulphide is evaporated. Fumigation was effected by pumping the gas into the first vat filled with seed ; after half an hour the gas was transferred from the first vat to the second vat. Whilst it was acting here, the seed was emptied from the first vat. In not a single case was a larva found to have survived the fumigation. The results are shown in a table, which also gives the corresponding data in the controls. With certain improvements, outlined in this paper, the machine could be regularly used in ginneries, the only objection being the use of gases which are either poisonous or inflammable. Provided proper precautions are taken, the danger is almost negligible. The original cost of a machine for dealing with 162 bushels an hour would be between £E.300 to £E.400. The cost of the chemicals may be put at about 2½*d.* per 5·447 bushels of seed. A mechanical cleaning apparatus, built by Messrs. Wm. R. Dell & Son, of Mark Lane, London, has been erected on the State Domains estate at Sakha. In the first part of this machine an inner cone revolves within an outer one and separates the seed from adhering lint ; in the second part the seeds are subjected to a wind which carries away lint, dust, light seeds, etc. In the original trials in London, the treated seed had an increased germination of 17 per cent., a large quantity of bad seed being removed without any damage being done to the remaining seed. When re-erected in Egypt, it gave fairly good results in throwing out the majority of seeds infested by pink boll worm and killing most of the remaining larvae, but the seeds were at first found to be injured by the process. Trials were made to find the best adjustment of the machine, but so far as germination was concerned, results as good as those recorded in London were never obtained. This machine is not to be recommended for *Taqawi* seed, but ought to be found very useful for treating bad seed from third, fourth and fifth pickings. Seed from the last pickings of badly infested crops is practically unsaleable. From such samples this machine will rescue a large proportion of the good seed which would obtain a ready sale for crushing.

Annual Report of the Saskatchewan Naturalists' Club 1914.—*Dept. Agric., Province of Saskatchewan, Regina*, 1915, pp. 47–71, 10 figs.

During 1914, *Pemphigus populi-transversus* (poplar petiole gall-louse) affected a great number of Carolina poplars at Moose Jaw. It was also general on cottonwoods and Russian poplar. *Leptocoris trivittatus* (box-elder bug) appeared in large numbers at Moose Jaw during the autumn. A Cercopid bug appeared in April, attacking garden vegetables. *Anthomyia* sp. was plentiful on radish, turnip and onion. *Proteopteryx willingana* (box-elder twig-borer) was observed at Cottonwood. The Noctuid, *Ipimorpha subvexa*, caused the curling of the leaves of Carolina poplars during 1913. *Agrotis* sp. (cutworms) destroyed large quantities of garden produce at Pense in June. A second brood occurred later and migrated northward. *Pieris* (*Pontia*) *rapae* was reported at Moose Jaw. Three species of blister beetles, *Cantharis nuttalli*, *C. viridans* and *Epicauta pennsylvanica* were observed, the first two species being found on *Psoralea argophylla* [scurvy pea] and on lupins. *Leptinotarsa decemlineata* occurred in large numbers at Regina. *Melanactes* spp. and *Cryptohypnus* (*Hypnoidus*) sp. were reported on wheat. *Chrysobothris* sp., a black, boring Buprestid, was common in June and July. The larch saw-fly (*Lygaeonematus erichsonii*) was observed at Indian Head, whence it has been spreading westward.

Burgess (A. F.). **Report on the Gipsy Moth Work in New England.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 204, 21st May 1915, 32 pp., 5 plates, 3 figs., 6 maps, 5 tables.

The gipsy moth work conducted by the Bureau of Entomology can be divided into (1) field work, consisting of scouting, hand methods of control and inspection, and (2) experimental work, including the introduction of parasites and natural enemies, study of food-plants, and investigation of the relation of silviculture to the gipsy moth problem. The collection of natural enemies of *Lymantria* (*Porthetria*) *dispar* and *Euproctis chrysorrhoea* from European countries and from Japan has been carried on since 1905. Observations in Germany have shown that a pronounced obstacle to the increase of the pest can be furnished by the presence of unfavourable food, and further, that a contagious "wilt" disease is very effective in controlling the moth. In all, about 30 enemies of the moth have been introduced into New England: many of these have been received in sufficient numbers to liberate under field conditions. Two species of hymenopterous parasites, *Anastatus bifasciatus* and *Schedius kuvanae* have been successfully reared. *Apanteles lacteicolor*, another hymenopterous parasite, deposits its eggs in the moth larvae in August. The eggs of *Compsilura concinnata* are deposited in the larva in early spring; the *Compsilura* larva, after reaching maturity, burrows through the epidermis of the host and pupates. *Calosoma sycophanta* has been found to do very effective work by feeding on the larvae and pupae of the gipsy and brown-tail moth. *Meteorus versicolor* has become well established. Investigations have been carried on for the purpose of securing information as to the identity of the wilt disease and the factors favourable to its increase. Observations on the food-plants

have led to the tabulation of species favourable or unfavourable to the different stages of the life-history. Experiments to determine the increase of the moth have shown that the introduction of parasites has already had definite results. Dispersion seems to be due to the carrying of egg-clusters on timber, etc., or to the spreading of the adults by wind. Secondary insects are important in that they prevent the recovery of many trees which would otherwise gradually recover. Damage to forest trees cannot be controlled by hand methods such as are possible in the case of fruit or ornamental trees. In Europe, the problem has been partly solved by growing species not susceptible to attack. Investigations on the feeding habits indicate that the work of eliminating the most susceptible trees is likely to have good results. A survey of the county of Middlesex in Massachusetts has been made in order to obtain information concerning the distribution of the various kinds of timber. Scouting operations carried out in various localities have consisted in examining the territory along the outside border of infestation and in treating colonies adjacent to the border for the purpose of preventing spread of the insect to other parts. Spraying work during the summer has given satisfactory results. Quarantine work has been confined to infested regions in New England and New York. The object of the work is to prevent egg-clusters or larvae of the gipsy moth, or winter webs of the brown-tail moth, from being carried out of infested regions.

Quaintance (A. L.). **The Apple Tree Tent Caterpillar.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 662, 11th May 1915, 10 pp. 7 figs.

The tent caterpillar (*Malacosoma americana*) is a native American species occurring generally in the United States from Canada south to Florida and west to the Rocky mountains. It usually feeds on the wild cherry, which is probably its native food-plant. In the absence of this, it attacks apple, plum, peach, elm, etc., often completely defoliating the trees. Eggs are deposited in early summer, in masses encircling the smaller twigs. The larvae, though they begin to develop the same year, do not hatch till the following spring. Nests of silk are formed on the leaves of the host plant and in these the larvae take shelter during the early stages. Pupation takes place in any protected place, under loose bark, etc., the cocoons usually occurring singly. This species is subject to attack by numerous parasites and predaceous insects, *Calosoma scrutator* being the most important of the latter. The caterpillars are also subject to a bacterial disease. Among the methods of control are the collection of eggs, destruction of larvae, removal of useless, infested trees, and spraying with arsenicals. The collection of egg-masses is quite practicable when the leaves are absent; the twigs bearing them should be cut off and burned. Nests containing the larvae may be removed by hand, or if present on the smaller twigs, may be burnt out with an asbestos torch. Any arsenical insecticide may be used: Paris green or Scheele's green in the proportion of 1 lb. to 150–200 U.S. gals. of water, or lead arsenate at the rate of 2 lb. to 50 gals. water, with 2 lb. of slaked lime, have been found effective. Preferably, the poisons should be used in dilute lime-sulphur

wash or Bordeaux mixture, thus combining treatment for insect and fungus diseases. On such trees as cherry, peach, and plum, lead arsenate is best, as the other insecticides are likely to injure the foliage.

MARLATT (C. L.). **The True Clothes Moths.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. 659, 5th April 1915, 8 pp. 3 figs.

Tinea pellionella, Tineola bisselliella and *Trichophaga tapetzella* are the most common species of clothes moths. *T. pellionella* is a northern species, the larva of which feeds on woollen materials, fur and feathers. There is one generation annually, the moths appearing from June to August. In the south the adult is found from January to October and there are two or more broods annually. The larva constructs a characteristic case in which it lives. The pupal stage, which is passed through within the larval case, lasts about three weeks. The larvae are parasitised by species of Hymenoptera, viz.: *Erochus ovatus* and *Apanteles carpatus*. *T. bisselliella* is typically a southern species having two broods annually, the adults appearing in June and in August and September. The larva feeds on similar materials to *T. pellionella* and is also a serious pest in museums. The silk spun by the larva is loose, and does not form a case as in *T. pellionella*. *T. tapetzella* occurs in carpets, tapestries, etc. The larva enters directly into the material it infests, constructing burrows in which the larval and pupal stages are passed. *Apanteles carpatus* has been reared from this species. Articles attacked should be thoroughly brushed and exposed to sunlight. Tarred paper is of some value against the adults. Furniture covered with woollen cloth may be sprayed with benzine or naphtha or sponged with diluted corrosive sublimate. The best method of protection is cold storage. A temperature of 40° F. renders the insect dormant. The larva of *T. bisselliella* will survive a temperature of 18° F., but an alternation of a low temperature with a comparatively high one (40°–50° F.) invariably results in its death. Goods should be submitted to two or three such changes of temperature before placing them permanently in a temperature of from 40°–42° F.

WEBSTER (F. M.). **The Chinch Bug.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. 657, 6th May 1915, 28 pp. 9 figs.

Blissus leucopterus occurs throughout the eastern and central parts of the United States. In the east, timothy grass is the principal food-plant; in the central States, grain crops, including maize, millet, wheat, rye and barley, are attacked, while in Mexico, sugar-cane is frequently injured. The long-winged form, occurring between the Rocky and Allegheny Mountains, has two generations a year, appearing in May or June and in August. The adults of the second generation hibernate in grass or fallen leaves. The eggs deposited in spring hatch in from 10 to 21 days; the whole life-cycle occupies about 40 days. The short-winged form in the east has one generation annually; it is incapable of flight. During the time of hatching, this species is susceptible to weather conditions, frequent rains during this period being fatal to it. The fungus, *Sporotrichum globuliferum*, has been introduced into infested localities. There is no absolute proof that

this fungus attacks and kills otherwise healthy individuals; injury may be confined to spent females or to weakened forms of both sexes. The method of sowing small patches of millet, Hungarian grass, etc., in early spring, has been successfully tested by the author, and has served to keep the bugs from the main crop. The attacks of the short-winged form on timothy meadows can be fairly efficiently controlled by crop rotation. The coal-tar method of control has given very good results, especially when post-holes are dug along the line at distances of 10–20 feet. The bugs collecting in the holes can be easily destroyed by the use of kerosene. A modification of this method is the formation of a double furrow separated by a ridge; the top of the latter is rendered smooth and on it is placed a line of coal-tar or crude petroleum. Holes are dug, as before, at close intervals. Furrows without petroleum or coal-tar may be used in localities where irrigation is practised. [For other methods of control see this *Review*, Ser. A, ii, pp. 226–228.]

CHITTENDEN (F. H.). **The Squash-Vine Borer.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 668, 26th May 1915, 6 pp., 2 figs.

The larva of the squash-vine borer (*Melittia satyriniformis*, Hb.), causes serious damage to pumpkins and other Cucurbitaceous plants by boring through the stems, causing them to rot at the affected points and become severed from the vine, or so injuring the vine as to cause the leaves to wither and the plant to die. So far as is known, the borer is a native of the Western Hemisphere. In the United States it has been recorded from the New England States, Georgia, Alabama, Louisiana, etc. It is evidently of tropical origin, and occurs in Mexico, where it is widely distributed, and in Panama, Venezuela, Argentina and the lower Amazon. The larvae bore through the stems of the host plant from the roots to the base of the leaf-stalks; young larvae have also been found in the larger leaf veins, when the eggs have been deposited in such locations, and they also attack the fruit. The moth appears in May or June, when the plants are sufficiently advanced for oviposition. Eggs are laid on all parts of the plants; the larvae hatch out in 6–15 days, attaining their maximum growth in 3–4 weeks. When mature, they enter the soil to pupate. Probably two generations are produced annually. The borer is very difficult to control, as insecticides are of no value after the insect has entered the stems. Since the insect passes the winter in the soil, pumpkins should not be grown in the same field in successive years. Good results have been obtained by planting a few early varieties between the rows of the main late crop. The early varieties attract the insects in large numbers. Harrowing the surface of infested fields in autumn exposes the cocoons to the cold, while ploughing in spring to a depth of at least 6 inches prevents the escape of the adults. The growth of secondary roots should be encouraged by covering the stems with earth. Cutting out the borers after they have entered the stem is useful and capture of the moths before oviposition is advisable.

WOODWORTH (C. W.). **Aphids on grain and Cantaloupes.**—*Univ. California Agric. Coll., Berkeley*, Circ. no. 125, January 1915, 4 pp., 1 fig. [Received 10th August 1915.]

Aphis avenae and *A. gossypii* are serious pests in the Imperial Valley. Sexual forms of *A. avenae* occur in the autumn in the northern sections and the winter is passed in the egg stage. Parasites and predaceous insects do not materially decrease the numbers of aphids in seasons favourable to the latter. The cost of spraying, though an efficient method of control, is generally considered prohibitive, when field crops have to be treated. When the host plants become infested in the spring, it is usual to find the insects limited to a few plants upon which they become very numerous before spreading over the fields. In this case, many growers sprinkle gasoline on infested plants and burn them, which appreciably delays general infestation.

QUAYLE (H. J.). **Spraying for the Grape Leaf-hopper.**—*California Univ. Agric. Coll., Berkeley*, Circ. no. 126, March 1915, 6 pp., 2 figs. [Received 10th August 1915.]

Typhlocyba comes occurs in destructive numbers in the Sacramento, San Joaquin and Imperial valleys. The insect passes the winter as an adult, which may feed on various plants growing in the vineyard. In spring, this pest feeds exclusively on the grape leaves. Nymphs begin to hatch about 1st May in the Fresno section and two or three weeks earlier in the Imperial Valley. The eggs require from 8 to 12 days to hatch and maturity is reached about 18 days later. There are two generations in the year, the young of the second generation appearing in the latter part of June. For the Fresno section, the time for spraying is from 20th May to 10th June. [For spraying materials and other methods of control, see this *Review*, Ser. A, ii, p. 282.]

GARCIA (F.) & RIGNEY (J. W.). **Onions, Spinach, Cauliflower and Casabas.** *New Mexico Agric. Expt. Sta., State College, Las Cruces*, Bull. 92, January 1915, 41 pp., 8 figs. [Received 3rd August 1915.]

The cabbage aphis (*Aphis brassicae*) is the most troublesome pest of cauliflower in New Mexico. Kerosene emulsion has proved effective against it. The only remedy for the harlequin bug (*Murgantia histrionica*) is hand-picking and destruction with kerosene. The use of spraying materials for vegetables is not recommended; thorough cultivation should be sufficient to prevent insects from gaining a foothold. The attack of an insect may frequently be prevented by growing at a different season.

MORRILL (A. W.). **Sixth Annual Report for the year ending June 30, 1914.** *Arizona Commiss. Agric. & Hortic., Phoenix*, 24th December 1914, 47 pp., 14 figs., 3 plates. [Received 13th August 1915.]

The inspection of imported nursery stock showed a marked decrease with regard to insect and red spider infestations. Apples and pears were in several cases infested by the codling moth (*Cydia pomonella*).

Chrysomphalus aurantii, *C. aurantii citrinus* and *Aspidiotus rapax* were found on citrus fruits. No progress has been made in averting the danger of pests being introduced by post. Orchard inspection has consisted of work in connection with the San Jose scale (*Aspidiotus perniciosus*) and with a new citrus disease in the Salt River Valley. The continuance of the work against the codling moth has resulted in the improvement of spraying equipment. *Coccus* (*Lecanium*) *hesperidum* (soft brown scale) is gradually regaining its normal numbers, following the check in January 1913. A hymenopterous parasite has been introduced in one locality with good results. The *Parlatoria* scale on date palms has been eradicated by burning. Investigation of the harvester ant (*Pogonomyrmex barbata*) in a badly infested lucerne field was undertaken, but the use of carbon bisulphide for eradicating the colonies met with negative results. Studies of the green fruit beetle were continued. A survey of the cotton insects of Arizona has been undertaken and a series of experiments was made in 1913 to determine the value of various fly trap baits and poisons.

The most notable deciduous fruit pest of 1914 was *Haltica foliacea* (south-western green flea-beetle), which attacks apple foliage in the larval and adult stages. Bordeaux mixture, with which lead arsenate may be combined, is generally used against it. *Macrodactylus uniformis* (western rose chafer) was destructive in one locality. Treatment consists of spraying with lead arsenate, 5 lb. of powder, 1 gal. molasses and 100 gals. water. Injury by *Termes flavipes* was reported from several places. *Frankliniella* (*Euthrips*) *tritici* was destructive to late-flowering peas in Salt River Valley. *Nysius ericae* (false chinch bug) was observed on green peaches near Tucson. This unusual appearance in an orchard may have resulted from the overcrowding of some weed upon which it naturally breeds. *Lachnosterna* sp. and *Diplotaxis popino* appeared in June in the south-east part of Santa Cruz County. The larvae were especially abundant round peach trees; the roots of strawberry plants were also attacked. *Scirtothrips* (*Euthrips*) *citri* was abundant during 1913. *Cicada cinctifera* appeared in large numbers in the citrus belt of the Salt River Valley in the spring of 1914. The young attack the roots of citrus, alfalfa, olive, peach, etc. *Euxoa* (*Chorizagrotis*) *agrestis* (western army cutworm) was very numerous in the spring of 1914. A species of blister beetle, *Tegrodera erosa*, appeared in a lucerne field. Sudan grass was attacked by *Chaetocnema ectypa* (corn flea-beetle), against which applications of Bordeaux mixture and lead arsenate failed to give satisfactory results. *Sphenophorus callosus* was found on the roots of maize at Morenci. The same weevil has previously been recorded as a serious pest in North Carolina. The only protective measure is to plough up and burn the stubble in infested fields as soon as possible after harvest. The chief pests of garden crops were flea-beetles, *Aphis gossypii* (melon aphis), grasshoppers, and *Murgantia histrionica* (the harlequin cabbage bug). The Tenebrionid, *Blapstinus pimalis*, previously unknown as a pest, was reported on many vegetables, showing a preference for cabbage. Since the insects occur just below the surface of the soil, the use of a poisoned bait consisting of chopped cabbage and Paris green would probably give satisfactory results. The most serious cotton pest of 1914 was *Aphis gossypii*. The abundance of this insect was probably due to the inefficiency of *Hippodamia convergens* and

other natural enemies in controlling it. The Arctiid, *Estigmene acraea*, and *Alabama argillacea* were observed in some localities; the former species also attacked *Physalis angulata* var. *linkiana*. The cotton boll-worm (*Chloridea obsoleta*) did no serious damage; about 38 per cent. of the eggs were parasitised by *Trichogramma pretiosum*. *Melanoplus differentialis* was found on cotton near Phoenix. *Bucculatrix thurberiella*, a new pest of cultivated cotton, was found in the Salt River Valley. This leaf-mining caterpillar has previously been recorded on Arizona wild cotton (*Thurberia thespesiodes*). When nearly full-grown, the larvae eat their way to the surface of the leaf, continue feeding there for a short time, then undergo pupation on the leaf. The Rutelid, *Cotalpa consobrina*, was found on cottonwood trees and was abundant in South Arizona in July.

Bruner (L.) & Swenk (M. H.). **Report on Operations under the Horticultural Inspection Law.**—*Bull. of the State Entomologist of Nebraska, Lincoln*, Bull. 4, 20th March 1915, 16 pp. [Received 10th July 1915.]

During the years 1913–14, all nurseries known to the State Entomologist were inspected twice yearly. In the inspection of foreign importations, 106 shipments of nursery stock were examined. Egg-masses of *Orgyia* (*Notolophus*) *antiqua* (vapourer moth) have been found several times on roses from Holland. Pupae of a Noctuid moth were found on cherry from France. Among scale-insects, *Coccus hesperidum* (soft brown scale) occurred on bay trees from Belgium, *Diaspis boisduvalii* on palms from Belgium and *Lepidosaphes ulmi* on box from Holland. *Gracilaria zachrysa* (*azaleae*) and *Aleurodes* sp. on azaleas from Belgium and Holland respectively; Aphids on maple from Germany, and on hydrangea and roses from Holland; red spider (*Tetranychus*) and mites from Belgium and Holland. Regular notification has been made of plants imported from the gipsy and brown-tail moth quarantine area in New England. Shipments of bulbs showed some infestation by *Rhizoglyphus hyacinthi* (bulb mite); in several cases fumigation was ordered. A few trees affected with what is apparently the San José scale (*Aspidiotus perniciosus*) have recently been noticed.

Lewis (D. E.). **Orchard Spraying.**—*Kansas State Agric. Expt. Sta., Manhattan*, Bull. 203, February 1915, 44 pp., 15 figs. [Received 6th July 1915.]

The method of preparation of each of the following fungicides is given: Copper sulphate, lime, Bordeaux mixture, and lime-sulphur concentrate. The method of determining the concentration by means of the hydrometer is described, together with a dilution table for concentrates testing from 15° to 35° Baumé. Ammoniacal copper carbonate and soap are frequently used upon nearly mature fruit; the formula for making 50 U.S. gals. is as follows: Copper carbonate, 6 oz.; strong ammonia, 3 pts.; soap, 1 lb.; water, 50 gals. The ammonia is diluted with two or three times its volume of water, the carbonate is dissolved in it and the solution made up to within 5 gals.

of the total amount. The soap, after being dissolved in the remainder of the water, is added to the carbonate solution. Among insecticides, the preparation of lead arsenate, Paris green, arsenite of lime, tobacco, kerosene emulsion and soap solution are described. Home-made lead arsenate can be prepared according to the following formula: Lead acetate, 14 ozs.; sodium arsenate, 5 ozs.; water, 50 gals. The common formula for arsenite of lime is: White arsenic, 1 lb.; stone lime, 2 lb.; water, 2–4 gals. A detailed description of different kinds of spraying machinery is given. Dust spraying is not recommended for use in Kansas orchards. It is better to apply the dormant spray in spring shortly before the buds open.

Howard (W. L.). **Profits from Spraying Twenty-five Missouri Orchards in 1914.**—*Univ. Missouri Agric. Expt. Sta., Columbia*, Bull. 124, January 1915, pp. 187–285, 5 figs., 43 tables. [Received 16th August 1915.]

The demonstration orchards were, with one exception, sprayed during the spring and summer with solutions of Bordeaux mixture and lime-sulphur to control diseases, with lead arsenate added as an insecticide. Lime-sulphur and Bordeaux mixture seemed equally efficient in controlling disease; the cost of Bordeaux mixture was about $3\frac{1}{4}d.$ per tree for each application, whereas that of lime-sulphur was about $4\frac{1}{2}d.$ Powdered lead arsenate appeared to give as good results as the paste when used in half the quantity by weight. The powder, however, costs about twice as much per pound as the paste. While Bordeaux mixture is a reliable fungicide for all preventable orchard disease, it is a dangerous fluid to use for a calyx spray, especially on apples having a light-coloured skin, on account of the serious scorching which may occur. Soluble sulphur, as at present sold commercially, is dangerous to use as a summer spray, being apt to destroy the leaves and calyx. The soluble sulphur seems to set free a large amount of arsenic from the arsenate and this causes the injury. This form of sulphur is, however, a promising spray material. Two applications during 1914 produced excellent fruit, but caused about 75 per cent. of the leaves to drop. Where three applications were given, from 10–25 per cent. of fruit was destroyed. Bordeaux arsenate and pyrox are good fungicides and insecticides, but are apt to scorch the fruit. Fruit-growers are advised to spray three times: Before blooming, immediately after blooming, and from 10 to 14 days later. For the first spray, lime-sulphur, (3 gals. to 100 U.S. gals. water) or Bordeaux (6 lb. copper sulphate, 6 lb. fresh lime, 100 gals. water) should be used; for the second, lime-sulphur 3–100, plus 5 lb. arsenate of lead paste; for the third, the same as the second, or Bordeaux 6–6–100, plus 5 lb. lead arsenate paste.

Weiss (H. B.). **New Jersey Nursery Insects for 1914.**—*Canadian Entomologist, London, Ont.*, xlvii, no. 5, May 1915, pp. 165–166.

The following is a list of the commoner pests found in New Jersey nurseries, mostly on ornamental plants, which occupy 2,400 acres, only 200 acres being planted with orchards and bush fruits:—*Aspidiotus perniciosus*, Comst., on a great variety of plants;

Lepidosaphes ulmi, L., on lilacs, poplars and willows; *Gossyparia spuria*, Mod., on elm; *Chionaspis euonymi*, Comst., on *Euonymus; Aspidiotus forbesi*, Johns., on cherry; *Pissodes strobi*, Peck., more abundant than usual in white pine; *Scolytus rugulosus*, Ratz., common in neglected peach and cherry stock; *Cryptorrhynchus lapathi*, L., in poplars and willows; *Agrilus viridis*, L., var. *fagi*, Ratz., fairly abundant in *Rosa rugosa*; *Agrilus sinuatus*, Oliv., in pear, scarce; *Galerucella luteola*, Mull., on elms; *Cyllene robiniae*, Forst., in locust; *Melasoma scripta*, L., on poplars and willows; *Podosesia syringae*, Harr., in lilacs; *Macronoctua onusta*, Grt., very abundant, doing considerable damage to iris in many parts of the State; *Zeuzera pyrina*, L., in lilacs, shade trees, pear and apple stocks in northern New Jersey nurseries; *Hyphantria cunea*, Dru., on all kinds of trees and shrubs; *Ceratomia catalpa*, Bois., on catalpa; *Vanessa antiopa*, L., on Lombardy poplars and elms; *Thyridopteryx ephemeraeformis*, Steph., on spruce, arbor vitae, lilac, maple and deciduous cypress; *Pteronus ribesii*, Scop., on currants and gooseberries; *Vespa crabro*, L., and allied species stripping bark from various plants, especially lilacs; *Leptobyrsa explanata*, Heid., on rhododendrons; *Trioza tripunctata*, Fitch, on blackberries in southern New Jersey nurseries; *Eriophyes pyri*, Pgst., on pear; *Eriophyes quadripedes*, Shimer, on silver maple; *Aphis forbesi*, Weed, on strawberry roots in southern New Jersey nurseries, scarce; *Chermes abietis*, L., scarce, on spruce in northern New Jersey; *Aphis pomi*, De G. (*mali*, F.), very abundant during the past season and doing considerable injury to apples; *Eriosoma* (*Schizoneura*) *lanigerum*, Hausm., on apple; *Tetranychus bimaculatus*, Harv., on evergreens and shade trees.

SANDERS (G. E.). Entomological Branch, Dominion Dept. Agric. **Some of the Benefits from Spraying with Arsenates in the Apple Orchards of Nova Scotia.**—*Canadian Entomologist, London, Ont.*, **xlvii, no. 5, May 1915, pp. 137–141.**

A six- to seven-year-old orchard in the Annapolis valley was sprayed in order to determine the extent of benefit derived from each of the four applications normally employed there. The spray used was commercial lime and sulphur, one to thirty-five, and Swift's acid paste lead arsenate, 5 lb. to 100 gals. Spraying reduced the number of bud-moths (*Eucosma ocellata*) by 60·75 per cent. and fruit worm (*Rhagoletis pomonella*) injury by 65·19 per cent. in 1912. In 1913, with a much lighter infestation throughout the orchard, the benefit was 63·56 per cent. reduction in fruit-worm injury. The codling moth (*Cydia pomonella*) infested 4·54 per cent. of the control apples in 1913. It was found that the second application of spray gave 71·3 per cent. reduction in injury, the third 65·6 per cent., and the fourth 65·6 per cent. The first application was made when the buds were bursting, as soon as the first bud-moth started eating its way into the bud; the second was applied from two to three days before the blossoms opened; the third immediately after the blossoms fell; and the fourth two weeks later. The results obtained were almost entirely derived from the second and third sprayings, the additional benefit of the fourth application being so small as to be scarcely noticeable.

Apples are seldom worth less than 1 dollar per barrel on the trees in Nova Scotia. Out of every hundred barrels grown by proper spraying in orchards similarly situated to the one mentioned, it may be reckoned that forty-five barrels of picked quality fruit and 12·97 per cent. of Nos. 1 and 2 quality fruit are due to insect control alone, which costs 10 dollars per hundred barrels for two applications. This does not include any benefit from black spot control, which is even a more important problem. The experiment was conducted to show that when the weather is fine and black spot absent, the spray is not wasted on the trees, as the entire four or five applications which the plant pathologists recommend to keep black spot off the various varieties in Nova Scotia are paid for two or three times over by the reduction of insect injury.

BENTLEY (G. M.). **Tenth Annual Report of the State Entomologist and Plant Pathologist for 1914.**—*Tennessee State Bd. Entom., Knoxville*, March 1915, 92 pp., 25 figs. [Received 13th August 1915.]

Investigations of the following insects have been carried on: Clover leaf weevil, peach-tree borer, strawberry root louse, corn-root worm, army worm, cotton-leaf worm, and pickle worm. The number of officials for inspection of nursery stock has been considerably increased, thereby rendering the work more efficient. Orchard and apiary inspection has been carried out on a small scale. Pruning and spraying demonstrations have been given, and an exhibition of economic insects arranged. In discussing problems of insect control, emphasis is laid on the importance of crop rotation and clean cultivation. During 1912, *Aphis forbesi* and *Macrosiphum fragariae* were found on strawberry plants in nine localities. Investigations into the life-history of these insects were carried out. On 10th January 1914, the aphids in all stages of development were found on the under side of strawberry leaves. On 12th January several parasites emerged. Later collections yielded many parasitised individuals. The parasite was identified as *Lysiphlebus testaceipes*; this species also attacks *Toxoptera graminum*. Plants infested with *A. forbesi* or *M. fragariae* should be dipped in diluted Black Leaf 40 or fumigated with hydrocyanic acid. The introduction of the gipsy moth and the brown-tail moth has up to the present been successfully checked. In dealing with the question of orchard protection, the author is of the opinion that State supervision is necessary for inspection for harmful insects and fungi and for carrying out suitable spraying. The care of nursery stock has greatly improved and the occurrence of the San José scale has been reduced to a minimum. Shipments of plants from England, France, Holland and Belgium have been inspected for crown gall, San José scale, brown-tail and gipsy moth.

MAY (D. W.). **Report of the Porto Rico Agricultural Experiment Station. 1914.**—*Washington*, 1915, 35 pp., 3 plates. [Received 3rd August 1915.]

The report of the entomologist states that the work dealing with the life-histories and habits of important insect pests has been continued. The most troublesome pests have been the mole-cricket,

shot-hole borers and ants, and no advance in methods of control of these insects has been made. May beetles and the sugar-cane root and stalk borers have been important in the cane district. In the Mayaguez section there have been outbreaks of the caterpillars of *Megalopyge krugii*, damaging guamá (*Inga* spp., coffee shade trees) and coffee foliage; of *Diabrotica innuba* and *D. bivittata*; and of *Xyleborus* sp., which has killed numbers of guamá trees. During the summer *Plutella maculipennis* (diamond-back moth) did some damage to cabbage, but was reduced in numbers when the heavy rains began. There was a local outbreak of the Geometrid, *Melanchroia corraria* (*cephise*), in Camuy, *Phyllanthus distichus* being almost defoliated. *Apate francisca* has been numerous about Mayaguez and has ten recorded host plants. It has been taken in living *Salix humboldtiana* and in dry posts of *Picramnia pentandra*. The most important work of the year has been in connection with the pests of coffee and coffee shade trees, and with a bacterium pathogenic to May-beetle larvae. Of the remedial measures for the control of *Scapteriscus didactylus* (mole-cricket) tested at the station, one seemed to give promise of satisfactory results. This was the strewing over infested areas of a mixture of phosphorus and corn-meal. *Leucoptera coffeella* (the coffee leaf-miner) is abundant in coffee-growing sections of the island. The eggs are laid singly on the upper side of the leaf. The larva immediately after hatching enters the leaf tissue; the larval stage, lasting from 11 to 13 days, is passed entirely within the leaf. Pupation takes place on the underside of the leaf, the adult emerging in from 6 to 8 days. Liberian coffee seems to be free from serious attack. The miner in the larval stage is parasitised by two Chalcids, *Chrysocharis livida* and *Zagrammosoma multilineatum*. Spraying infested trees with 1 pint of nicotine sulphate in 100 U.S. gals. water containing 5 lb. soap in solution, is effective against the pupae, if applied with considerable force to the underside of the leaves, but the results do not repay the expense and labour involved. Spraying against eggs and larvae gives no practical results. *Xyleborus* sp. was the most troublesome pest of shade trees for coffee, such as *Inga laurina* and *I. vera*. In some hill districts large areas of *I. laurina* were killed. Trees should be felled and converted into charcoal as soon as the beetle is noticed. An undetermined pink *Coccus*, attended by the ant *Myrmelachista ambigua ramulorum*, attacked the branches of guamá, resulting in the destruction of new growth and the weakening of branches. The removal of infested branches from isolated trees a few years ago was successful, but constant inspection is necessary. Banding trees with tanglefoot and the use of poisoned bait have been unsuccessful in ridding trees of the attending ants. The larva of *Megalopyge krugii* has been abundant on guamá. Coffee, especially the Liberian variety, was also attacked. It is usually parasitised by a Tachinid fly and by *Chalcis ovata*; the latter is an important check on this pest. The disease of *Lachnosterna* due to *Micrococcus nigrofasciens* is confined to the larva. The bacterium is present in the soil, but its efficiency cannot be increased, since infection takes place only through a wound in the integument of the larva. The Arctiid, *Ecpantheria eridanus*, was found on orange trees in the Mayaguez district. The egg-masses are laid on the leaves and hatch out in 5–8 days. The larva reaches maturity in about five weeks. Pupation takes place in a loose

cocoon, from which the adult emerges in 17 days. The leaves of banana, bucare and sweet potato were also attacked. *Euscepes* (*Cryptorrhynchus*) *batatae* appeared during the winter in light, dry soil. Sweet potatoes should not be left in the ground after they are full grown, neither should they be planted in soil infested during the previous season. *Grevillea robusta* (silk oak) was attacked by *Asterolecanium pustulans*. This scale forms pit-like depressions on the small branches. A lime-sulphur spray will control it. Some damage to tobacco seed-pods by *Chloridea* (*Heliothis*) *obsoleta* was noticed. The commonest weevil is *Diaprepes spengleri*; the adult has a variety of host plants and the larvae have been reared from the roots of sugar-cane, orange and sweet potato. On citrus trees, eggs are laid in masses on the upper leaf surface, and are protected by the rolling over of the edge. After hatching, the larvae drop to the ground. The attacks of the adult may be controlled by arsenical sprays.

BUTLER (O.). **Notes on the Preparation of Bordeaux Mixture.**—*New Hampshire Agric. Expt. Sta., Durham, N.H.*, Circular no. 15, May 1915, 10 pp., 2 figs.

The formula for Bordeaux mixture selected as a type is the one most generally met with, and contains copper sulphate 4 lb., quicklime 4 lb., water 50 U.S. gals. (41½ Impl.); this is usually known as the 4–4–50 mixture. The effect of the method of mixing in producing a greater or less volume of precipitate is pointed out and the adoption of a method which gives the most slowly settling mixture is recommended. An ideal Bordeaux mixture would be one which, after a given lapse of time, would show no perceptible settling. The relative value of hydrated lime and quicklime is discussed, preference being given to the latter, which produces a finer milk of lime. As hydrated lime is in the form of a powder, there is no way of telling to what extent it has deteriorated by becoming carbonated on exposure to air; carbonate of lime cannot be used in Bordeaux mixture. Temperature influences the bulkiness of the precipitate very considerably, and a mixture made with water at 50° F. is about twice as valuable as one made with water at 54° F., and three times as valuable as one made with water at 65° F. The temperature of the solution after it has been made has a marked influence on its durability. The time required for a 4–4–50 Bordeaux mixture to deteriorate completely varied from 192 hours at 48° F. to 3 hours at 86° F. Cane-sugar, recommended by Kelhofer, is by far the most efficient preservative, the addition of 2 oz. to 50 U.S. gallons being sufficient to prevent deterioration for a considerable length of time. The addition of this small amount in threatening weather will permit, should rain ensue, the maintenance of the mixture in good condition until work can be resumed. As an akaline Bordeaux mixture cannot contain any copper in solution, a test for alkalinity is the only one needed. If the mixture is not alkaline, there may be copper in solution. When a 4–4–50 mixture is made with a good quality of quicklime, the test is superfluous. Proprietary Bordeaux mixtures are obtainable either in powder or paste form. Powdered Bordeaux mixture does not change with age; its value depends on the care exercised in its

manufacture. The copper in Bordeaux mixture paste is always in such a physical condition as to be nearly worthless for the purposes for which it is intended, and the purchase of Bordeaux mixture paste is a waste of time and money.

RABATÉ (E.). **Les bouillies riches en sulfate de cuivre; qualité des bouillies cupriques.** [Sprays rich in copper sulphate; the properties of cupric sprays.]—*Rev. Vitic., Paris*, xlii, no. 1088, 6th May 1915, pp. 377–381.

After recording the properties required of a good cupric spray solution, various methods of determining the presence of small quantities of copper are described. The following solutions are particularly rich in copper: A pure ¼ per cent. solution of copper sulphate; a 1 per cent. solution of verdigris; a solution of ammonia and copper oxide: a solution of 2 lb. copper sulphate and 47 liquid oz. of 22° ammonia in 20 gals. water. The value of a spray depends also on the quantity and quality of the copper deposit in reserve on the foliage. In solutions very rich in soluble copper the clear fluid above the precipitate is usually blue in colour, but some commercial solutions were found to be coloured with methylene blue; this gave a beautiful blue colour, but no soluble copper was present. A concentrated solution of sodium hyposulphite will remove all trace of colour from a solution of copper sulphate. If a solution of sodium carbonate is poured into the colourless fluid, no more precipitate is formed, provided the sulphate is free from salts of iron or zinc. This method is recommended as a test for purity. Another way of detecting the presence of iron is provided by the addition, firstly of a little nitric acid to the copper sulphate solution, in order to superoxidize the iron, and then of an excess of ammonia; the resultant light blue fluid will be clear if the sulphate is pure, while flakes of ferric oxide will be seen in the liquid if iron is present. In order not to confuse necessary laboratory research with the results obtained in cultural practice, it suffices to say that various acid, neutral or basic sprays, rich in soluble copper, have proved of great value against mildew. Among such may be mentioned Bordeaux mixture containing 2 per cent. of copper sulphate with the addition of one of the following: ¼ per cent. of copper sulphate added just before use, producing a slightly acid solution; ¼ per cent. of ammonia, producing a light blue alkaline solution; $\frac{1}{16}$ to $\frac{1}{12}$ per cent. of casein mixed in water with an equal quantity of powdered or paste lime; 1 per cent. of molasses thinned with water.

FONZES-DIACON (—). **Sur les bouillies cupriques.** [Copper spray mixtures.] *Rev. Vitic., Paris*, xlii, no. 1088, 6th May 1915, pp. 384–385.

It has been found by various chemists that in Bordeaux mixtures the greater part of the copper is rendered insoluble in the form of basic sulphates, the basicity varying more or less directly with the quantity of lime used to precipitate a given weight of copper sulphate. The bluish green precipitate of the acid mixtures consists principally of tetracupric sulphate, which is present in greater proportion at the

beginning of neutralisation than at the end (4 molecules of lime to 5 of copper sulphate, as against 9 molecules of lime to 10 of copper sulphate). The proportion of decacupric sulphate is relatively large in this mixture. The value of the mixture is more or less proportional to the quantity of tetracupric sulphate which it contains, as, of all the basic sulphates of copper, this is the one which under the action of the CO_2 of the air will steadily yield the largest proportion of free cupric sulphate. According to the author, the Burgundy mixtures do not contain so large a proportion of basic sulphate owing to the CO_2 set free by the decomposition of the sodium carbonate which they contain; the acid mixtures contain chiefly the bluish green tetracupric sulphate, which is converted into the blue pentacupric sulphate by excess of sodium carbonate: sulphates of higher basicity are not formed, because the CO_2 set free by the reaction produces a hydrocarbonate of copper (CO_3, CuO, $2H_2O$), which increases in quantity with the quantity of sodium carbonate in excess. In the positively alkaline Burgundy mixtures, the precipitate chiefly consists of the blue hydrocarbonate, but this is rapidly transformed into the green monohydrated carbonate which is but little soluble in liquids containing CO_2 in solution and is therefore of little value as a fungicide. The supernatant liquids in all cases contain a certain proportion of copper in solution. In the acid Burgundy mixtures this soluble copper exists partly as bicarbonate, which decomposes rapidly when exposed to the air, and by combination with the excess of $CuSO_4$ yields an insoluble tetracupric sulphate; the balance is converted into hydrocarbonate, which is again of small value. In Bordeaux mixtures the fact that the lime used always contains a very appreciable amount of carbonate results in the production of a considerable amount of bicarbonate of copper which, in the acid mixtures, yields tetracupric sulphate: this will be much less in the neutral mixtures and in the alkaline mixtures. These contain but a small proportion of bicarbonate of copper and this is rapidly converted into hydrocarbonate, the form in which the copper is least active. It would thus appear that the acid mixtures are to be preferred, inasmuch as they contain the largest proportion of tetracupric sulphate.

VERMOREL (V.) & DANTONY (E.). **Sur la Composition des Bouillies Bordelaises et sur le Cuivre Soluble qu'elles renferment.**—[On the composition of Bordeaux Mixtures and on the soluble copper they contain.]—*Progrès Agric. et Vitic., Montpellier*, no. 19, 9th May 1915, pp. 438–442.

The authorities who have dealt with this subject are by no means agreed as to the condition in which the insoluble copper exists in Bordeaux mixture, some asserting that it is present as hydrate, and others that the hydrate is associated with various basic sulphates of copper or double sulphates of copper and lime. Nearly all are, however, agreed that only the acid mixtures contain the copper actually in solution. The authors have confined themselves to investigating the commercial products and ordinary water, i.e. to vineyard conditions, and they arrive at the following conclusions:—

Acid Bordeaux Mixtures. However these are prepared, they contain neither hydrates nor double sulphates, but solely basic sulphates of

copper. Careful experiment was made as to the effect of carbonic acid in solution in the water, and it was found that very appreciable quantities of copper could be washed out of the precipitate in solution, but that the solvent action of the water containing CO_2 gradually diminished owing to the conversion of the whole of the copper into carbonate.

Alkaline Bordeaux Mixtures. It was found that, using the same quantities of the same lime, it was possible to obtain two mixtures in which the constitution of the precipitate differed. (*a*) Blue Mixture: Concentrated milk of lime prepared from good, freshly slaked lime is poured rapidly into the solution of sulphate of copper or vice versa; the reaction in either case takes place in a strongly alkaline medium; the quantity of lime used should be such that there is an excess of 0·1 per cent. when the reaction is complete. Technical chemical proof is given that the precipitate formed under these conditions consists of a mixture of copper hydrate associated with calcium sulphate and traces of basic sulphates; the supernatant liquid, though strongly alkaline, contains some copper in solution (23 parts in 10,000); the precipitate, when treated with water containing CO_2 in solution, yields an appreciable proportion of dissolved copper. (*b*) Green Mixture: Dilute or concentrated milk of lime, but, if concentrated, prepared from a lime which is partially carbonated, is poured in small quantities at a time into the sulphate of copper solution, which is violently shaken up after each addition; the quantity of lime used is the same as before, but the reaction now takes place in an acid medium; the precipitate formed is no longer blue, but has a definite greenish colour and consists almost exclusively of basic sulphates of copper, but probably of a higher basicity than those formed in the acid mixtures, as they are not so soluble and the reaction between them and the lime is much slower. Chemical proof is given that the constitution of the precipitate in the green mixture is unstable and that it has a natural tendency to revert more or less to the composition of the blue type, depending on the amount of lime in excess. It is not certain whether these changes have time to take place on the leaves before the lime is completely converted into carbonate.

It is thus obvious that green and blue alkaline Bordeaux mixture are two entirely different products, and it is not difficult to understand why it is almost impossible to prepare the blue mixture with the ground lime of commerce, each grain of which is encased in an envelope of carbonate which greatly delays solution. The composition of the supernatant liquid (blue or green mixture) is practically the same in both cases. The general results of these experiments show (1) that the acid mixtures contain basic sulphate of copper and not hydrates as generally supposed; (2) that of the two alkaline mixtures, the blue contains hydrates and the green basic sulphates; (3) that alkaline mixtures, contrary to the generally accepted opinion, all contain at the moment of use sufficient copper in solution to prevent the germination of the vine mildew; (4) that alkaline mixtures, though not yielding much copper in solution at first to the action of CO_2, gradually yield a considerable amount, whilst the acid mixtures yield a great deal at first and but little afterwards, as the whole of the copper is rapidly converted into carbonate which is not readily soluble. After thirty years of use, the vineyard owner is still in doubt as to

which mixture is the best. The value of any of them depends on the quantity of soluble copper present to a certain extent, and provided there be sufficient, there is no proof that the alkaline mixtures, though containing less copper in solution at the moment of use, are any less efficacious than the acid containing approximately five times as much. Ravaz states that three parts of copper sulphate in a million of water are sufficient to stop the germination of the mildew spores, and thus the weakest Bordeaux mixture is 75 times stronger than necessary, if this be true. The authors conclude by saying that there is no distinction to be made between the various Bordeaux mixtures; either acid or alkaline should have the same value.

SEMICHON (L.). **Nouveau procédé de traitement des insectes et des cryptogames par l'eau chaude et les bouillies chaudes.** [A new method of insect and cryptogam control by hot water and hot spray mixtures.]—*Rev. Vitic., Paris*, xlii, nos. 1089 & 1090, 13th & 20th May 1915, pp. 398–405 & 424–425.

The bulk of the information given in this paper has been taken from a previous article [see this *Review*, Ser. A, ii, p. 685]. The larvae of *Arctia caja* and *Haltica ampelophaga* are also killed by hot water at temperatures between 122° and 150° F., which destroys the eggs of these two species and of *Sparganothis pilleriana*, as well as of those of *Clysia* and *Polychrosis*. Vine pests may be treated with hot water at any time during the three weeks which elapse between the date of oviposition and that on which the larvae take shelter within the injured plants, whereas arsenicals are efficient for a period of about five days only. If hatching is spread over three or four weeks, one careful application of hot water, or two at most, will allow of absolute theoretical control; the proportion of survivors found in practice depends simply on the thoroughness of the treatment. Hot water is also effective against *Tetranychus telarius*, *Eriophyes* (*Phytoptus*) *vitis*, and probably Coccids also. Treatment should only be carried out in dry weather, not after rain or dew. Stress is laid on the proper method of filling a knapsack sprayer (of 26¼ pints capacity) when a hot spray solution is used instead of plain hot water. In the former case, 8¾ pints of treble strength solution (cold) is poured into the container and the latter is then filled by adding 17½ pints of boiling water, briskly stirring the while. The operator should apply the spray at once. The degree of heat mentioned increases the efficiency of the sprays used against the vine mildew (*Plasmopora viticola*), black-rot (*Guignardia bidwelli*) and the *Phytophthora* of the potato and of the tomato.

RAVAZ (L.). **Traitement contre les insectes.** [Insect pest control.]—*Progrès Agric. Vitic., Montpellier*, lxiii (32nd year), no. 20, 16th May 1915, pp. 457–461.

Referring to M. Semichon's hot water method of pest control [see this *Review*, Ser. A, ii, p. 685], an account is given of the use of steam by M. Bonneau in Anjou some years ago, the experiments being

described by MM. Maisonneuve, Moreau and Vinet. The steam was supplied from a portable boiler at a pressure of 110–140 lb., equal to a temperature of 340° to 360° F.; it issued with such violence as to tear off some fragments of bark. After steaming, a number of stocks were decorticated, and out of 50 *Clysia* larvae only six were found alive, equal to a mortality of 88 per cent. A more extensive test made a couple of days later resulted in a mortality of 90 per cent. Only about 30 stocks were treated in an hour; a larger boiler and improved fittings would probably make this treatment economically feasible.

VERMOREL & DANTONY. **Préparation rapide des Bouillies à la Caséine.** [The rapid preparation of sprays containing casein.]—*Progrès Agric. Vitic., Montpellier*, lxiii, (32nd year), no. 22, 30th May 1915, p. 509.

The following is an easy method of preparing a stock solution of casein for addition to Bordeaux mixture in order to increase its wetting and adhesive properties: $3\frac{1}{2}$ oz. of casein in powder is well stirred in $1\frac{3}{4}$ pints of water until completely in suspension. Without stopping the mixing, add $1\frac{3}{4}$ pints of milk of lime, the strength of which is not material; it may vary from 2 oz. to 8 oz. per $1\frac{3}{4}$ pints of water. Dissolution takes only a few seconds. In carefully closed containers, this solution will keep indefinitely; for use, add 2 parts (by volume) to every 100 parts of Bordeaux mixture.

DESSOLIERS (H.). **Abattoirs à Sauterelles.** [Locust abattoirs.]—*Bull Agric. Algér. Tun. Maroc., Algiers*, xxi, no. 5, May 1915, pp. 109–113.

Locusts have indifferent sight and, except in an atmosphere well heated by the sun, they fly close to the ground and even then with some difficulty. Their invasions of Algeria are always effected through certain gaps in the Atlas Mountains. On resuming their journey on the day after that on which they have alighted, the swarms follow the general lines of the gap. In a head wind, dense swarms fly along the surface of the spurs they are crossing. It is in such spots that the swarms are thickest and that nets, 7 yards in height and from 45 to 110 yards in length, should be hung. Observations made by the author at Maïnis since 1892 show that with a head wind the locusts strike the nets in dense masses; a rear wind drives them on to the meshes, but in reduced numbers; in calm weather very few individuals attempt to avoid the obstacles, which they seldom seem to perceive. They fall into a trench covered with zinc hoppers, with sides at an angle of 45°. Attracted by a suitable light, they move out into the open by means of a cross tunnel and pile themselves up in chambers covered with netting with a mesh of $\frac{1}{5}$–$\frac{1}{4}$ inch and impregnated with heavy oil. To enable air to circulate through the mass of insects the chambers have an open-work wooden floor.

Starvation and the heat of the sun soon kill the locusts. As these insects are attracted by light, it is easy to lead them to a pit where they will pile themselves up to a height of 30 feet or more. Putrefaction is prevented by adding dry phosphates and plaster to the mass from time to time. A rich compost is produced and this may easily be removed by means of a tunnel connecting the bottom of the pit with the hill-side. If it is not desired to capture the locusts, nets of 1 inch mesh should be impregnated with heavy oil or with a suitable virus in dilute solution. The insects will be contaminated in flying through the netting and their destruction will soon result. The author states that during 23 years he has in vain drawn the attention of the authorities to the advantages offered by nets in locust destruction.

Berlese (A.). **La distruzione della** *Diaspis pentagona* **a mezzo della** *Prospaltella berlesei*. [The destruction of *Aulacaspis pentagona* by *Prospaltella berlesei*.]—*Redia, Firenze*, x, pts. 1–2, 20th May 1915, pp. 151–218.

It is stated that by the end of 1914 the destruction of *Aulacaspis pentagona* by *Prospaltella berlesei* was nearly completed and the special legislation regarding it had been abrogated. Parasitised material has been dispatched to the Argentine and Switzerland with excellent results, while this method of control has been begun in Spain. A bibliography of 177 references is included in this paper.

Del Guercio (G.). **Ulteriori ricerche sullo stremenzimento o incappucciamento del Trifoglio.** [Further research on the stunting or curling of clover.] *Redia, Firenze*, x, pts. 1–2, 20th May 1915, pp. 235–301, 42 figs.

This condition of common clover, which is not necessarily due to insect attack, was first noticed by the author in Tuscany in 1911. The affected plants were attacked by various insect pests. A Scolytid beetle, *Hylastes trifolii*, was found in the roots; where such infestation was rare or in its initial stage, considerable infestation of the stems by a weevil, *Apion virens*, and of the heads of clover by *A. apricans* was noticed. Other insects included Thysanoptera, Cecidomyids and Aphids. Of these, the Cecidomyid larvae are of serious economic importance. Of the Nematodes, *Tylenchus devastatrix* deserves special mention. *Heterodera* spp. are of less importance. *Tylenchus* spp. are found in the clover roots from the spring of one year to that of the next. Subject to natural interruptions, this is also the case with Cecidomyid larvae. *Hylastes* and *Apion* spp. occur from early spring up to late autumn. The imagines of the latter then issue from the stems and hibernate at the base of the flowers in the head, while *Hylastes* remains in the root during winter. Should the plants have suffered to such a degree as no longer to afford sufficient nutriment, the *Hylastes* migrate from them to stronger plants. In spite of the assertions of systematic workers, the Scolytid of clover is peculiar to this plant and does not migrate.

CONFIENZA (F.). **La tignola dell' uva.** [The vine moth.]—*Consigliere dell' Agricoltore, Turin*, iii, no. 5, May 1915, pp. 165–166.

Trials made by the Cattedra Ambulante di Agricoltura of Turin show that a 1 per cent. solution of lead arsenate or a 1½ per cent. solution of phenicated tobacco extract [tobacco extract rendered useless for other purposes by the addition of a little phenol] are the best sprays against the vine moth.

BENCOMO (C.). **El Pasador del Tabaco.** [The tobacco wireworm.]—Privately printed [*sine loco*], 1915, dated from *Port au Prince, Haiti*, 31st July 1914, 13 pp., 1 plate.

The numerous workers who have studied the insect pests of tobacco only mention the tobacco wireworm, *Agriotes* (*Elater*) *segetis*, in a general way, owing to the fact that this insect is properly an enemy of cereals and vegetables. Only in Cuba has it specially attacked tobacco, and this is due to the fact that from 1855 to 1860 the Cuban tobacco planters were in the habit of growing vegetables in their plantations. Later, this custom was discontinued and the larvae of this pest, having enormously increased, were compelled to feed on the roots of the tobacco plant. If lettuce roots are provided, the wireworms will attack them in preference to those of their accustomed host. As an instance of the ignorance existing in Cuba with regard to this pest, the author states that, in 1911, light-traps were recommended as one means of controlling the adult beetles, which are diurnal in habit. In Cuba, the adults emerge in April, mate in May and die shortly afterwards. The eggs are laid in lots of ten at the base of the young plants. The larvae remain near the surface of the soil up to October in the first year and from April onwards in the succeeding ones. Complete development takes from three to four years in warm climates, five years in cold ones. The greatest injury is done in the second and third years. The author does not believe that injections of carbon bisulphide are of much use, and also discountenances watering the soil with a solution of crude naphthalene in water. As a radical, cheap and speedily efficient control, he suggests that in the first or second week in July the ground intended for planting should be covered with dried cane-trash, dried grass, etc., which should then be burnt. The rapid, intense flame will destroy the larvae without calcining the humus layer. When worked into the soil, the ash will kill any surviving larvae. After harvesting the tobacco crop, all green material should be dried or burnt; if required for manure it must be removed and stored elsewhere under proper conditions. The universal adoption of the above methods for three consecutive years should eradicate the pest.

v. FEILITZEN (H.). **Ett svårartat angrepp av dvärgstrit pa höstrag hösten 1914.** [A serious attack of *Jassus sexnotatus*, Fall., on autumn rye, in the autumn of 1914.]—*Landtmannen, Linköping*, xxvi, no. 19, 8th May 1915, pp. 169–172, 4 text figs.

Attacks by *Jassus sexnotatus* have previously been recorded only twice in Sweden, viz., in 1902, in Skane, on oats, and in Blekinge on

sugar beets. On the exhibition field which was prepared in Jönköping in connection with the jubilee exhibition in that town, an attack was noted on a plot on which autumn rye had been sown at different dates. On the plot on which the rye had been sown earliest, the 23rd of August, the rye began to turn yellowish-grey on the 11th of September. On closer examination the insects were found in such numbers that a veritable cloud appeared above the plot when they were disturbed with a stick. They were also found in the grass round the plot, from which they had evidently migrated. By the 19th September the rye was yellow and the following spring the ground was quite bare, most of the plants being dead. The attack was probably due to the unusually high temperature between February and August and to the small rainfall.

The insects lay their eggs on or in the leaves and the larvae hatch in ten days. At the end of September imagines appear, and if the climatic conditions are favourable, the eggs laid by them hatch, otherwise they hibernate. The nymphs do more damage than the imagines, being more stationary. According to Tullgren, there are two generations a year in Sweden.

Rostrup (Sofie). **Forsog med sprøjtemidler mod bedelus** (*Aphis papaveris*). [Experiments with sprays against *Aphis papaveris*.]—*Beretning fra Statens forsøgsvirksomhed i plantekultur*, 92, *København*, pp. 234–256, 1915.

In 1911 in Denmark, experiments with sprays, including nicotine sprays, against *Aphis rumicis* (*papaveris*) were conducted, but owing to the want of exact knowledge of the composition and strength of the latter, no reliable results were obtained. Therefore in 1913 and 1914 analyses of the nicotine sprays were made and experiments carried out in order to ascertain the strength and quantity of sprays giving the best results. The plants sprayed were seed turnips and especially horsebeans, the latter crop being chosen as it is more liable to attack from *A. rumicis* than any other plant. The results of the experiments are summarised as follows: (1) Pure nicotine and extract of tobacco are of the same effectiveness, the result depending only on the percentage of nicotine. (2) The addition of soap does not increase the effect of the spray, nor is soap solution alone very effective. (3) Pyridine is quite ineffective. (4) 0·1 per cent. of nicotine is sufficient, and when the attack is not serious even less may be used, although 0·05 per cent. probably is too little. (5) It is necessary to use plenty of spray as the plants must be thoroughly wetted; for horsebeans, 15 gals. per acre are necessary. (6) A sufficient amount of spray is more necessary than a high percentage of nicotine, thorough spraying with 0·05 per cent. solution giving a far better result than using half the amount of a 0·1 per cent. solution. (7) The fluid is more effective against the young plant lice than the full-grown ones and better against the wingless than against the winged lice. ***Macrosiphum*** (*Siphonophora*) *pisi*, a large species often occurring in company with *A. rumicis* is more resistant to the spray. Coccinellids in all stages, *Sitones lineatus* and thrips were found alive on the plants, whereas *Lygus*

campestris was killed. (8) The spraying is effective against aphids even when they are not directly wetted by it. Shortly after the application, lice which were hidden, emerged and evidently suffered from the odour of the nicotine.

The cost of the operations was as follows :- 44 lb. nicotine extract, 19s. 5d. ; 4 days' wages, 5s. 3d.- total, 24s. 8d. The cost of three sprayings of 1 acre thus amounted to £3 14s. 0d. The increased yield of the sprayed area was in the case of seed turnips about 5½ cwt. per acre, the net profit being about £4 per acre. When the attack spreads gradually from the border of a field, much can be achieved by daily cutting off and destroying the attacked shoots, and it is always worth while trying this method before the more costly spraying is undertaken.

QUINN (G.). **Report of the Horticultural Instructor.**—*Rept. of the Minister of Agriculture of South Australia for the year ended June 30th, 1914, Adelaide,* 1915, pp. 24–31. [Received 10th July 1915.]

The examination of fruits, plants and seeds imported into and exported from the State was continued. No serious invasions of new pests were reported. Of the Fiji bananas, 2,820 bushels were fumigated on account of scale. Experiments with a liquid bait called "Frenler" against the codling moth gave negative results. Considerable time was devoted to the inspection of citrus plantations on the plains of Adelaide for the detection of *Aspidiotus aurantii* (red scale). Results showed that the scale was being controlled and that fruit free from its presence was the rule rather than the exception. *Blastophaga grossorum* (fig wasp) was established in one orchard containing a Capri Fig Tree, Roedings No. 3; the latter carried two summer broods and a large number of winter fruits contained the insect. *Lepidosaphes ulmi* (*Mytilaspis pomorum*), apple mussel scale, a pest very prevalent in Mount Gambier, appeared at Penola. *Otiorrhynchus cribricollis* was fairly abundant ; the method of placing oil traps round the stems of infested trees gave good results. Mount Gambier potato crops were affected by the caterpillars of *Phthorimaea operculella* (*Lita solanella*). In plots sprayed against Irish blight it was noticeable that the moth affected the tops of plants sprayed with bluestone mixture much less severely than unsprayed plants. In the district south of Adelaide, codling moth was destructive to late apples. Red spider was troublesome in some districts. Considerable damage was occasioned by the green peach aphis (*Rhopalosiphum dianthi*) in the Barossa district ; the blossoms and young fruit were attacked. The apple tree root borer (*Leptops*) was recorded in the Wirrabara district ; the best control methods were spraying the foliage with lead arsenate, trapping the beetles by means of zinc bands round the trunks of affected trees, and gathering them after shaking them to the ground. During the summer *Eriocampoides limacina* (*Selandria cerasi*), pear and cherry slug, appeared over a considerable area near Angaston. The favourite food was the foliage of some varieties of pear ; cherry and hawthorn were also attacked.

Patterson (W. H.). **Report of the Entomologist.**—*Rept. Agric. Dept. for the year 1914*, Accra, Gold Coast, 1915, 72 pp. [Received 31st August 1915.]

Experiments against *Sahlbergella singularis* and *S. theobroma*, two pests of cacao, were continued. The only spray capable of killing the insects was kerosene emulsion, consisting of 1 lb. yellow soap, 4 gals. kerosene and 60 gals. water. Tests were made with a pneumatic sprayer; the trees showed no signs of injury after six monthly applications. The native food-plant was found to be *Eriodendron anfractuosum* (silk cotton tree); the insect seemed to prefer young, rapidly growing trees and caused lesions similar to those on cacao. It is reasonable to suppose that (1) the removal of all silk cottons in the neighbourhood of cacao cultivations, (2) the destruction by burning of all dead branches during the dry season, (3) the frequent examination of the trees during the growing season, backed by legislation to enforce co-operative treatment, should be the means of placing the control of this pest on a satisfactory basis. Extended work with *Helopeltis* sp. (cacao mosquito) suggested that some of the damage formerly credited to it was due to another suctorial bug, *Homoeocerus* sp.; *Glenea* sp., a bark borer, gave signs of becoming a serious pest at Aburi. Plantations of coconuts between Accra and Cape Coast were free from *Archon centaurus* (rhinoceros beetle), although this insect was abundant at Assuantsi. *Ceratitis colae* (cola fruit-fly) was wide spread throughout the Colony.

Misra (C. S.). **The Rice Leaf-Hopper (*Nephotettix bipunctatus*, Fabr.).**—*Nagpur*, 8 pp., 6 figs. [Received 20th August 1915.]

The presence of *Nephotettix bipunctatus* in the Raipur and Bilaspur Districts was first observed late in 1913. In 1914, the pest appeared early and caused serious damage to the rice crop by sucking the juices from the young plants. The insect usually appears in small numbers in July; eggs are laid either in the stems of green grasses or in nursery seed-beds. The eggs of later generations are laid in the tissue of the rice leaves. The nymphs attach themselves to the midrib, where they feed on the sap and at the same time exude a whitish sticky fluid which later becomes covered with fungus. The winter is passed in the adult stage. When badly infested, the host plants ultimately die. In localities where the pest has been present for over two years in succession, it is advisable to sow early ripening varieties of rice. The use of hand nets made of thin muslin before the seedlings are transplanted, or in the fields during July and August, will effect the capture of many early-appearing forms. Light traps placed in the fields on dark nights give good results. The trap consists of a lamp burning a mixture of kerosene and coconut oil placed over the middle of a pan containing water covered with a thin layer of oil. The flame should be situated just above the tops of the plants. After the crop is harvested, cattle should be allowed to graze over the ground.

FARLEY (A. J.). **Home Preparations of Lime-and-Sulfur Mixtures.** — *New Jersey Agric. Expt. Sta., New Brunswick, N. J.*, Circ. 21, 8 pp. [Received 27th July 1915.]

The following formula for the preparation of lime-sulphur concentrate is given: Stone lime 30 lb., sulphur 60 lb., water 30–35 U.S. gals. Directions for the dilution of the concentrate are added. A suitable formula for self-boiled lime-sulphur is: Stone lime 8 lb., sulphur 8 lb., water to make 50 gals. Four applications of the spray produce the most satisfactory results in the control of peach scab; against plum curculio (*Conotrachelus nenuphar*) arsenate of lead is added at the rate of 3 lb. of paste or $1\frac{1}{2}$ lb. of powder to 50 gals. of self-boiled lime-sulphur mixture.

WOODWORTH (C. W.). **Insecticide Formulas.** — *California Univ. Agric. Coll., Berkeley*, Circ. 128, April 1915, 7 pp. [Received 10th August 1915.]

The insecticides are given in order of their importance in California. *Arsenical sprays.* (i) Paris green, $1\frac{1}{3}$–2 lb.; lime, 6 lb.; water, 200 U.S. gals; (ii) neutral lead arsenate, 6–12 lb.; water, 200 gals. Paris green, London purple and zinc arsenite can be applied as powder at the rate of 4–6 lb. per acre, preferably while the plants are moist with dew.

Poisoned baits. Bran, 10 lb.; white arsenic, $\frac{1}{2}$ lb.; molasses, $\frac{1}{2}$ gal.; water, 2 gals.

Ant poisons. (i) For native ants: White arsenic, 2 oz.; washing soda, 4 oz.; sugar, 1 lb.; water, 1 pt.; (ii) for Argentine ants (*Iridomyrmex humilis*): White arsenic, 1 oz.; soda, 2 oz.; sugar, 20 lb.; water, 3 gals.

Petroleum oils. (i) Crude oils: Crude oil, gravity 18° Bé.; crude distillate (heavy), 30° Bé.; crude distillate (light), 50° Bé.; asphaltum; (ii) Refined oils: kerosene, 42° Bé.; gasoline, 60° Bé.

Oils with a high density and high flash point are desirable. Gasoline is used for woolly aphis (*Eriosoma lanigerum*) on apple and for wood-borers; kerosene is efficient against chicken lice, ticks, etc. Crude oil and distillate are spread in a thin film over water infested by mosquito larvae. Asphaltum is made fluid by heating and is used against the peach tree borer. Distillate spray, consisting of 10 to 20 gals. distillate, 5 lb. caustic soda and 200 gals. water, is applied against European fruit scale in the dormant season by means of a power sprayer provided with an efficient agitator. Miscible oils can be made by mixing cresol soap with kerosene, distillate or crude oil. Emulsions are the best form of oil spray; a suitable formula is soap, $\frac{1}{2}$ lb.; hot water, 1 gal.; kerosene, 1 gal.

Soaps. For plant lice, home-made soap can be made as follows: Water, 25 gals.; caustic soda, 8 lb.; fish oil, 3 pts.; resin, 20 lb.

OSBORN (H.). **Leaf-hoppers of Maine.** — *Maine Agric. Expt. Sta., Orono*, Bull. 238, April 1915, pp. 81–160, figs. 11–35. [Received 23rd August 1915.]

The economic importance of leaf-hoppers rests on their attacks on such crops as oats, timothy, wheat, on various fruits and on forest

and shade trees. In Maine, grass land has up to the present suffered more than cereal crops, and in the former situation the following species have been most in evidence : *Cicadula sex-notata*, *Deltocephalus inimicus*, *D. configuratus*, *Acocephalus striatus*, *Draeculacephala mollipes*, *D. angulifera* and *D. noveboracensis*. Damage to fruit and garden crops by *Typhlocyba comes* and *Empoasca mali* is frequently very serious. The species affecting forest trees are still so widely scattered that at present it is difficult to suggest any methods of control. While there is no immediate destruction of the trees attacked, the rate of wood formation is distinctly retarded. Among park and shade trees, birches especially suffer from attacks of *Oncopsis* sp. Conifers are injured by members of the family CERCOPIDAE and the punctures made serve as points of entrance for fungus diseases. Willows are infested by species of *Idiocerus*, *Pediopsis*, *Empoasca* and *Scaphoideus*. Methods of control that may be applied to leaf-hoppers attacking crops are clean culture, mowing, crop rotation, burning of grass lands in early spring or late autumn, spraying the newly hatched larvae, and the use of the hopper-dozer. A detailed description of the species found in Maine is given.

MERRILL (D. E.). **The Grape Leaf-hopper.**—*New Mexico Agric. Expt. Sta., State College, Las Cruces*, Bull. 94, April 1915, 33 pp., 8 figs., 1 plate. [Received 3rd August 1915.]

Typhlocyba comes (grape leaf-hopper) passes the winter in the adult stage. The hibernating individuals emerge from the middle of February until the beginning of April, and feed, before the grape leaves appear, on *Sophia ochroleuca* (pepper grass), lucerne, peas, spinach, etc. In New Mexico, in 1913, pairing was first observed on 19th April and the first eggs were deposited on 1st May. Nymphs were noted on 18th May ; the nymphal stage lasted from 13 to 18 days. The summer broods took, on an average, only nine days to hatch. There are two full broods and a small third brood each year, the last appearing in August.

DOTEN (S. B.). **Report of the Department of Economic Entomology ; Ann. Rept. of the Board of Control for the year ending June 30, 1914.**—*Univ. Nevada Agric. Expt. Sta., Carson City*, 1915, pp. 25–29. [Received 30th August 1915.]

Complaints of decreased yields of honey due to the presence of thrips in lucerne blossoms have been received for several years from out-lying portions of Nevada. Towards the end of the year 1913–14, preparations were made for the study of these insects. Outbreaks of cutworms in lucerne fields have been recorded at intervals. The investigation of certain Hymenopterous parasites of the codling moth were continued, and various methods of rearing and feeding such parasites received consideration.

RUSSELL (H. L.). **Report of the Director for the year ending June 30, 1914.**—*Univ. Wisconsin Agric. Expt. Sta., Madison*, Bull. 250, April 1915, 109 pp., 49 figs. [Received 26th July 1915.]

Observations and experiments on cranberry insects were continued. It was found that the anterior end of the cocoon of the cranberry fruit

worm (*Mineola vaccinii*) becomes soft and opens several days before the emergence of the adult. The determination of this condition makes it possible to institute control measures by flooding the land at frequent intervals for several weeks in June. Studies were made on a leaf-miner of the cranberry. The method of control of the onion maggot (*Hylemyia antiqua*) by means of sweetened sodium arsenite spray was tested. A period of 10–14 days elapses between the emergence of the adult and egg-laying, and it was possible to kill many flies during this time. *Phthorimaea operculella* (tobacco split worm) was found in some localities. Experiments were made to determine the value of lantern traps in the control of *Lachnosterna* spp. Many thousands of beetles were captured in four localities, and further observations will be made to record any appreciable decrease in the number of larvae. Grasshoppers appeared in large numbers in several localities. The cottony maple scale (*Pulvinaria innumerabilis*) suddenly became very abundant, destroying many shade maple trees. Reports were received early in the summer of the appearance of the army worm (*Cirphis unipuncta*) on the southern border of the State. Poisoned bran mash was at once used, thus checking any serious injury. A large number of aphids on many kinds of trees, shrubs and plants were in evidence during the summer. Considerable damage from cucumber beetles occurred in several sections. Additional localities infested with San José scale (*Aspidiotus perniciosus*) were discovered.

FRANKLIN (H. J.). **Report of Cranberry Sub-Station for 1914.**—*Massachusetts Agric. Expt. Sta., Amherst*, Bull. 160, April 1915, pp. 91–117, 6 tables. [Received 22nd July 1915.]

Malacosoma disstria (forest tent caterpillar) was abundant during May and June throughout the cranberry section; cranberry plants, however, were not damaged. A severe infestation of *Cirphis* (*Heliophila*) *unipuncta* (army worm) was reported from Cape Cod. *Lymantria* (*Porthetria*) *dispar* (gipsy moth) is becoming more abundant yearly on the uplands around the bogs; the following points in connection with this insect need to be determined: (1) Whether, in cases of serious bog infestation, the trouble arises from eggs laid on the bog in the previous year or from small larvae blown on to it early in the season; (2) whether the eggs can survive winter flooding if the water is retained until late in May; and (3) what is the best time to let the water return in order to destroy this insect. A bog should probably be flooded as soon as possible after the hatching of the eggs. The insect net recommended for discovering the first stages of the false army worm would be useful for detecting small gipsy moth larvae early in May. When an infested bog is flooded the larvae usually float ashore alive in large numbers and must be killed by burning or spraying with crude oil or kerosene. Attempts to destroy *Anthonomus suturalis* (cranberry weevil) by flooding were unsuccessful. Spraying with arsenicals at the time when the plants were in bud or after the blossoms had opened lessened the damage to some extent. The Geometrid, *Epelis truncataria* var. *faxonii* (spanworm), did considerable damage in one locality. Larvae of this insect collected on 23rd July 1913, pupated by 8th August; from 25–30 per cent. were parasitised by *Campoplex* sp. On 28th May 1914, living pupae

were found in large numbers, having survived a 5-months' submergence. *Perrisia vaccinii* (*Cecidomyia oxycoccana*), cranberry tip worm, was investigated during the year. The tips of the plants were examined before they showed injury, while the bog was in full bloom. Eggs and larvae in various stages of development were found. Three weeks later the infested tips had dried up and the larvae had disappeared without leaving cocoons. It was found that pupation occurred in the sand at the base of the plant. From 50 or 60 bogs examined, the following conclusions were reached: (1) That flooded bogs, if not resanded before 1st May, were usually more seriously injured than strictly dry bogs; (2) that flooded bogs which had been resanded in the previous autumn or in the spring before 1st April, were much less injured than those not resanded, most damage occurred in those not resanded for two years or more; (3) the "Late Howe" variety showed more injury than did the "Early Black"; (4) no bog showed great tip worm injury where there had been severe frost; (5) resanding every other year should be recommended as a control measure. General observations were made concerning the Tortricid, *Rhopobota vacciniana*, Pack. It was concluded that winter-flooded bogs which could not be reflooded in June must either have the flood retained late enough to kill the eggs (until about 20th June), or else be sprayed with arsenicals. The use of a sweetened spray would involve considerable difficulties, owing to the long hatching period during which the poison must remain on the plants. This insect does not seriously infest bogs without winter floods and, if the latter were omitted, would probably in time be controlled by weather conditions and natural enemies. Omission of winter flooding, however, results in an increase of the Pyralid, *Mineola vaccinii* (cranberry fruit worm). Late winter flooding seems to be the only reliable method of dealing satisfactorily with this insect, but a better treatment is desired, because the water does harm when held late every year. Experiments with insecticides have given no practicable results. For dry bogs, the possibility of starving out the insect by destroying the bloom in seasons of light crop is under consideration. The study of the natural enemies of the fruit worm was continued and the following species were bred in large numbers: *Phanerotoma tibialis*, the living young of which are inserted into the eggs of the host; *Pristomeridia agilis*, which inserts its eggs into the larva of the fruit worm; and *Trichogramma minuta*. The last-named species undergoes its entire development in the egg of the host, the adult emerging in July and August. About 56 per cent. of the fruit worm eggs on dry bogs were destroyed by this parasite. The majority of *P. tibialis* on flooded bogs perish during the winter and it may be advisable to attempt to keep them under artificial conditions by collecting fruit worms during the summer and allowing them to pupate. Submergence tests with the fruit worm showed that the pupa has great ability to resist drowning, apart from any protection afforded by the cocoon. The latter became completely filled with water in about five days; cocoons kept in stagnant water did not survive, while those submerged in sacks suspended in a pond were alive after 25 days.

HASEMAN (L.). **Chinch Bugs becoming dangerous.**—*Missouri Agric. Expt. Sta., Columbia*, Press Bull. 91, 13th May 1915.

Hibernating adult chinch bugs (*Blissus leucopterus*) begin to lay eggs in west-central Missouri in the early part of May. Those fields of wheat which are badly infested should be used for pasture before 25th May and then ploughed as deeply as possible to bury most of the eggs and young. If a crop is to be planted, cowpeas or soybeans are the best. Where there is a good crop of clover in the field, mowing the wheat closely will be sufficient; a ditch or log barrier can be used to check migration. Wheat which will give a partial crop need not be cut; the bugs in such fields can be destroyed after harvest, if barriers are properly used.

SCHREINER (J. F.). **Слоники и яблонный долгоносикъ, вредящіе плодовымъ садамъ.** [Species of *Rhynchites* and *Anthonomus pomorum* injuring orchards.]—**« Труды Бюро по Энтомологіи Ученаго Комитета Глав. Управ. З. и З.»** [*Memoirs of the Bureau of Entomology of the Scientific Committee of the Central Board of Land Administration and Agriculture,*] *Petrograd*, ii, no. 14, 1914. Third, enlarged edition, 65 pp., 32 figs. [Received 9th August 1915.]

Rhynchites pauxillus, Germ., occurs all over South and South-West Russia, along the steppe lands of the Volga, as far as Kazan and in Caucasia. In the government of Saratov, it appears at the end of April, in the Crimea in the first half of March, in Ekaterinoslav in the first half of April. The weevils feed at first both on flower and leaf buds, and later on the leaves, on which they oviposit. Oviposition takes place during the latter half of April and May, the eggs being laid in a hole made by the proboscis of the females in the petioles of the leaves. The larvae hatch in 6 or 7 days and enter the leaves, feeding on the parenchyma. The infested leaves drop from the trees in June and July. When mature, the larvae pass into the earth and pupate, producing adults in September, which mostly pass the winter in the earth, but in warm days in September and October they frequently emerge and injure the buds of fruit trees. Mokrzecki, in the Crimea, reared the parasites *Bracon discoides*, West., and *Pteromalus* sp. from this pest, but the author found no parasites in the government of Kiev in 1912, notwithstanding the large numbers in that year. He recommends the following remedies:—Spraying with milk of lime before the appearance of the weevils; spraying with the remedy of Chubuktchi, which is prepared as follows: about 20 gallons of washed clay are thoroughly mixed with about 30 gallons of water in a tub, while in another tub lime is mixed with water to the thickness of cream and about 20 gallons of this added to the clay and water; to each 15 to 25 gallons of this mixture 1 lb. of soap is added. Appliances used for shaking the beetles from the trees are described and figured, and digging the ground to destroy the larvae and pupae is advised.

Rhynchites bacchus, L., has the same distribution in Russia as the last species, appearing everywhere before the buds burst. These weevils injure with their proboscis the fruit and flower buds of apples, pears, cherries, apricots, plums and sloes, the injuries being more serious than those caused by *R. pauxillus*. These injuries were first

observed by Mokrzecki in 1898. The author has never observed that, as stated by Nordlinge, this pest partly cuts off the buds, so that they remain hanging by a small strip of the bark and wither. The adults later attack the flowers and, in May and June, the young fruits, which frequently wither in consequence. The females oviposit in the developing fruits of apples and apricots and, less frequently, of plums. The number of eggs in one fruit is differently given by various authors, Lindeman records 4, Mokrzecki, 10 to 15, and Portchinsky, 20. The larvae hatch in 7 or 8 days and eat into the kernel of the stone, or feed on the parenchyma. The larval period lasts $3\frac{1}{2}$ to 4 weeks, pupation taking place in the earth. The adults often appear in autumn and injure the buds of fruit trees, the tips of young shoots and also the petioles of leaves and fruit. These beetles winter underneath fallen leaves or the bark of trees, while others remain in the earth till the next spring. The larvae contained in the withered fruit remaining on the trees over the winter, develop very slowly and only mature in the following spring, when they pass into the earth to pupate ; the rotting of such fruits, which would have made the development of the larvae impossible, is prevented by the fungus, *Monilia fructigena*, Pers., which mummifies the fruits. Spraying with lime, and the collection and destruction both of fallen and mummified fruits are urged as remedies, the last two being the more effective. The habit of ovipositing chiefly on neglected, wild trees can be successfully utilised in control, by making use of such trees as traps.

Rhynchites giganteus, Kryn., is found in the governments of Ekaterinoslav, Charkov, Podolia, Kiev, Poltava, Taurida, Southern Saratov, in the Taganrog district of the province of Don, and in North and South Caucasia. The life-history of this pest was first studied by I. J. Shevirev. In Ekaterinoslav and Kiev, Taganrog and Caucasia, it appears in the first half of May, disappearing at the end of August or beginning of September. These weevils breed mostly on pears, although the author has also observed them on cherries, though no damage to these fruits was noticed. They first injure the buds and later feed on the skin of the fruit. The females oviposit in the fruits and the larvae hatch in 8 or 9 days and pass into the seed capsule where they feed on the seeds. They frequently also make a burrow from the capsule into the pedicel. The fruit generally drops after the larvae have emerged. The author found from 2 to 14 larvae in one fruit. The larval stage lasts according to him three weeks, and according to Shevirev, four weeks. When mature, they enter the earth, where they hibernate and pupate in spring. Hard winter varieties of pears are especially attacked, while soft, quickly maturing ones are less used for oviposition purposes, but are largely skinned. Besides shaking the trees, which is only practicable in May, it is advisable to spray with Paris green (6 oz. of green, 12 oz. of lime, $2\frac{1}{2}$ lb. of rye meal, in 27 gallons of water) not less than 3 or 4 times during the summer, beginning early in June. The fallen fruits should be destroyed.

Rhynchites auratus, L., is found everywhere in South and South-East Russia, in Caucasia, in South-Western Siberia and in Central Asia. The weevils usually appear at the time of the swelling of the buds, reaching their maximum numbers shortly after the blossoming and

disappearing in the first half of July. Early in spring they damage the buds, and later the flowers, driving their proboscis through the calyx and eating the reproductive organs. During the period of fruiting, they attack various fruits and have been observed feeding on young cherries, plums, apricots, apples, pears, sloes and even on gooseberries and bird cherries. Although it is usually stated that the insects oviposit exclusively in cherries, the author observed on the Volga, in 1907, that the females deposited their eggs in apples, especially of the China variety, pears, apricots, sloes and, less frequently, in plums. Spraying with Paris green in the same proportions as recommended for *R. giganteus*, before the weevils begin to pair, and again in 10 or 12 days, the use of sticky belts and shaking down the adults from the trees, are mentioned as remedies.

Rhynchites cupreus, L., is found everywhere in South Russia, appearing on fruit trees before the swelling of the buds and injuring those of plums, apricots, sloes, apples, medlars and service fruits. The females oviposit in May in plums, less frequently in cherries, also injuring the pedicel so as to cause the fruit to drop. Only one egg is laid in each fruit, the larvae appearing in 6 or 7 days. They feed on the parenchyma, mature in 5 or 6 weeks and pupate in the earth. The adults appear in the same autumn, but usually remain in the earth till next spring. The liming of trees, shaking down the weevils, and the destruction of fallen fruits are advised.

Rhynchites aequatus, L., occurs over many parts of South and East Russia, but is absent from North Russia. It injures the buds, and later the fruit, of plums, sloes, medlars, apricots and apples. The females oviposit both in medlars and apples. According to Reddeberg, they winter in the larval stage, but the author's observations in the government of Simbirsk tend to show that hibernation often takes place as an imago. The same remedies as against *R. cupreus* are recommended.

Byctiscus betulae (*Rhynchites betuleti*) is found everywhere in European Russia, Caucasia and Siberia, breeding in forests, on poplars, aspens, lime trees and hazel nuts, and in orchards on pears, apples, vines and nuts. They injure the buds and young leaves and oviposit in folded leaves on the tips of the shoots.

Anthonomus pomorum, L., is found all over European Russia and in Transcaucasia. The weevils appear early in spring before the swelling of the buds. The egg is deposited through a hole made by the female in the tips of the buds and then pushed down by the proboscis between the style and the stamen of the future flower. The larvae hatch in 7 or 8 days and feed on the stamens, anthers, style and stigma, without touching the ovary. Pupation takes place inside the bud, lasting 7 or 8 days. The whole cycle from egg to imago lasts about five weeks. The adults hibernate without producing offspring. The author has reared the parasite *Pimpla pomorum* from buds infested with this pest, which is also destroyed by ants and some insectivorous birds. Liming the trees, shaking down the weevils, and trap belts, in addition to the use of parasites as suggested by Portchinsky, are recommended.

Sokolov (N.). **Совки озимая и восклицательная.** [*Euxoa segetum* Schiff. and *Feltia exclamationis*, L.] **Защита растенiй отъ вредителей.** [The protection of plants from pests.] No. 3 (21), Supplement to—**«Любитель Природы.»** [*Friend of Nature*], *Petrograd*, 1914, 22 pp. [Received 21st August 1915.]

No marked differences in the life-histories of *Euxoa* (*Agrotis*) *segetum* and *Feltia* (*Agrotis*) *exclamationis* were observed, though the latter occurred in greater numbers. Digging operations in the fields, which were begun at the beginning of May, showed that the caterpillars mostly occurred along the edges of the bare spaces and practically none were found in the middle of them. Some of the caterpillars were infested with a fungus disease, and in some of the pupal chambers only the cocoons of the Ichneumon, *Banchus* sp., were found. The largest number of larvae and pupae were found on a fallow field, in which beets and turnips had been grown the previous year. Here the number of pupae was estimated at 26,700 per acre. The adults were controlled by means of bait trees, consisting of trees smeared over daily with broad belts of honey and molasses. Both species were on the wing after the middle of June, in numbers increasing up to the end of that month, when a decrease set in. The first eggs were found on 1st and 2nd July on various weeds, mostly on *Sinapis arvensis* (charlock) and *Cirsium arvense* (Canada thistle), less frequently on *Plantago* spp. ; also on convolvulus, chicory, beets and turnips. The caterpillars leave the plants on which they have hatched at a very early stage, and pass the day in the soil. From 25 to 30 per cent. of the caterpillars and pupae obtained by digging operations in spring proved to be infested with parasites, of which the most common was *Ichneumon sarcitorius*, others being the Ichneumons, *Anomalon* sp., *Ophion luteus*, *Banchus* sp., and a Tachinid, *Gonia* sp. The caterpillars found in August and later were largely infested with a bacterial disease, the percentage of diseased caterpillars increasing in time from 16 to 25 per cent. and 50 per cent., while some *Macrocentrus* sp. and other parasites were also reared from them. Spraying with Paris green in the proportion of 4 lb. of green and 8 lb. of lime in 110 to 115 gals. water, gave very good results ; spraying with barium chloride 1 lb., molasses $\frac{1}{4}$ lb., in 5 gals. of water, was tried on a turnip field and effected the destruction of the majority of the caterpillars. In trenches round the fields over 35,000 caterpillars were collected between the 26th August and 13th September. Many caterpillars were also destroyed in these trenches by *Carabus cancellatus*, *C. nemoralis*, *C. hortensis* and other species.

Moritz (L.). **Бiологическiя наблюденiя надъ прусикомъ или итальянской саранчей.** [Biological observations on *Calliptamus italicus*, L.]—**«Любитель Природы.»** [*Friend of Nature*], *Petrograd*, no. xi, November 1914, pp. 321–332. [Received 21st August 1915.]

Calliptamus (*Caloptenus*) *italicus* occurs throughout the south and south-east of European Russia and also in the Crimea, Caucasia, Transcaucasia, South Siberia in the province of Turgai, and in Turkestan. In this article the author describes his observations during

1914 in Turgai. Hatching took place during the second half of June, the whole cycle of development occupying about 43 days. The males usually acquired wings before the females. The swarms of the first stages move very slowly and in no definite direction, while those of the older stages move with an increased speed (the larvae of the fourth and fifth stages covered from 250 to 350 feet per day) and mostly from north to south. The direction is, however, frequently affected by wind, sun, hills, roads, etc. After acquiring wings it was difficult to discover the actual direction of the movement of the swarm. Pairing began 10 to 14 days after wings appeared. The egg-clusters were mostly found on the southern slopes of hills with a clayey or stony soil. The locusts feed on various steppe plants, mostly *Artemisia* sp., and attack cultivated plants only in the absence of other food or when meeting them on their way. In 1914, the injury was mostly to summer wheat, but oats, barley, fodder grass, potatoes and bachza plants also suffered. Other species of locusts found in the province of Turgai in 1914 included *Locusta* (*Pachytylus*) *migratoria*, L., *Oedaleus nigrofasciatus*, De Geer, *Dociostaurus* (*Stauronotus*) *brevicollis*, Eversm., *Arcyptera* (*Stethophyma*) *flavicosta*, L., *Stenobothrus* sp., *Oedipoda coerulescens*, L., *Celes variabilis*, Pall., *Podisma pedestris*, L., *Bryodema tuberculatum*, F., *Tmethis muricata*, Pall., and *Pyrgodera armata*, F. W. By the end of September most of the locusts had perished. *L. migratoria* being the only species which somewhat outlived *C. italicus*. About 12 per cent. were infested with larvae of *Sarcophaga lineata*, Fall., and other species. The egg-clusters are also destroyed by the larvae of *Epicauta erythrocephala*, Pall., and *Mylabris quatuorpunctata*, L., the adults being also frequently infested with *Trombidium* sp. Birds play a still greater part in destroying them, especially *Pastor roseus*, rooks, sparrows, etc. Remains of locusts were also found in the holes of the spiders *Trochosa singoriensis* and nests of *Lathrodectus tredecimguttatus*.

MORITZ (L.). **Нѣсколько словъ о каракуртѣ** *Lathrodectus tredecimguttatus*, Rossi. [A few words on *Lathrodectus tredecimguttatus*, Rossi.] **«Любитель Природы.»** [*Friend of Nature*]. *Petrograd*, no. 12, December 1914, pp. 365–372, 2 figs. [Received 21st August 1915.]

Lathrodectus tredecimguttatus, Rossi, popularly known in Russia as "caracurt," which means "black spider," is the most poisonous spider found in Russia, where it occurs all over the south from Bessarabia to the government of Orenburg, including the Crimea, as well as in the Caucasus, in the provinces of Ural and Turgai, and in Turkestan. It appears to prey to a large extent on locusts. The young spiders emerge from their cocoons in the first half of May and before concluding their development, during which they moult several times, they lead a nomadic life. When sexually mature, about one and a half months after hatching, the females build nests. Other spiders, *Saliphuga* sp. and *Lycosa* sp., as well as POMPILIDAE, prey upon them, and some Hymenoptera are parasitic in their eggs. The author found in their nests remains of *Zabrus* sp., the Tenebrionid, *Blaps mortisaga* and *Calliptamus* (*Caloptenus*) *italicus*, *Oedaleus nigrofasciatus*, *Dociostaurus* (*Stauronotus*) *brevicollis*, *Celes variabilis*

and *Oedipoda coerulescens*; he has also witnessed an attack by the spider on *Scarabaeus sacer.* The young spiders winter in the cocoons in which the eggs are enclosed, emerging in the next spring. Although the poison of the spider takes effect both on cattle and men, they attack the latter only when disturbed. A camel is stated to have died after having been bitten.

BOGOYAVLENSKAYA (M. G.). **Къ біологіи** *Haltica oleracea, L.* [On the biology of *Haltica oleracea,* L.]—**Отчетъ о дѣятельности Мико-Энтомологической Опытной Станціи Всероссійскаго Общества Сахарозаводчиковъ за 1914 годъ.** [Report on the work of the Entomological Branch of the Myco-Entomological Station of the All-Russian Society of Sugar-Refiners in 1914], *Kiev*, 1915, pp. 51–74, 22 figs.

Haltica oleracea, L. was frequently found on vines near Smiela and was first mistaken for *Haltica ampelophaga*, Guér. According to many authors, this insect is not a pest of cabbage or of any other cruciferous plants and the author's observations confirm this. In the laboratory the beetles refused to feed on cabbage, beet, or wheat, though they were frequently taken in the open on these plants. They however attacked vine leaves when offered them and this was also observed in the open. Experimentally they could only be induced to feed on *Rumex confertus, Polygonum aviculare* [knot-grass], *Oenothera biennis* [evening primrose], *Epilobium angustifolium* [willow herb] and *Vitis vinifera.* The larvae feed on the same plants as the adults. The various stages of *H. oleracea* are described. The enemies of *H. oleracea* mentioned, include *Zicrona coerulea*, L., and two species of Tachinids, not identified, one being a parasite of the adults and the other of the larvae. A bibliography of 18 works, of which 7 are in Russian, is appended.

POZNIAKOV (D. G.). **Виноградарство въ Херсонскомъ уѣздѣ въ 1914 г.** [Viticulture in the district of Cherson in 1914.]—**« Вѣстникъ Винодѣлія.»** [*Messager Vinicole*], *Odessa,* 1915, no. 3–4, pp. 87–91.

Very small numbers of larvae of *Clysia* (*Cochylis*) *ambiguella* and of *Eriophyes* (*Phytoptus*) *vitis* were found in some localities, the latter being practically harmless. *Epicometis* (*Tropinota*) *hirta* did some damage during the unfolding of buds, and termites were found on the decaying roots of very old vinestocks in one vineyard. No new infestions of *Phylloxera* were recorded and this pest has disappeared from the vineyards of two villages.

S. P. **Предстоящая борьба съ кровяной тлей.** [The coming measures against *Eriosoma lanigerum.*]—**« Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent,* no. 3, March 1915, pp. 313–315.

Eriosoma lanigerum has not yet been discovered in the provinces of Samarkand, Ferghana, Transcaspia and Semirietchensk, but a few years ago it was noticed round Tashkent and in some other places in

the province of Syr-Darya. The fruit-growing section of the Turkestan Agricultural Society proposes to approach the Military Governor of the province with a view to the issuing of a bye-law making measures against this pest compulsory under the supervision of a special committee.

Anutchin (A.). **О цѣлесообразности паразитарнаго метода борьбы съ вредителями.** [On the utility of the parasitic method of controlling pests.]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, no. 4, April 1915, pp. 381–390.

This is part of a paper on the present state of the question of controlling pests by means of parasites, read on 29th March last at a meeting of the Horticultural Section of the Agricultural Society of Turkestan. On the strength of data mainly drawn from the endeavours made in America to import parasites from other countries, the unfavourable results obtained by this system are pointed out. The author considers this method of control theoretically unsound, as it disturbs the equilibrium which obtains in nature only temporarily. The method advocated by Portchinsky, consisting in the utilisation of polyphagous parasites, by destroying their principal host by every possible means, and thus causing them to direct their energies to other pests, as well as the method of Rossikov, of assisting the multiplication of parasites by selecting and separating the infested hosts from the healthy ones, and destroying the latter, but not the former, are also regarded as ineffective. Instead of trying to "control the laws of Nature," the author prefers concentration on chemical and agricultural methods of control. The meeting did not entirely agree with the author's views, and expressed the opinion that there is no reason why the services of allies offered by Nature should not be utilised. All available methods should be employed in the control of pests.

«Бюллетень о вредителяхъ сельскаго хозяйства и мѣрахъ борьбы съ ними.» [*Bulletin on Pests of Agriculture and Methods of Control.*] Published by the Entomological and Phytopathological Bureau of the Zemstvo of the govt. of Charkov, *Charkov*, no. 5, May 1915, 33 pp.

The following article and notes relating to Entomology appear in this number:—

Averin (V. G.). **Состояніе сельско-хозяйственныхъ культуръ въ отношеніи вредителей по даннымъ Энтомологическаго Бюро и сообщеніямъ корреспондентовъ.** [A statement as to the pests of cultivated plants based on the records of the Entomological Bureau and reports of correspondents], pp. 18–20.

The following pests were reported in orchards in April: *Sciaphobus squalidus*, Gyll., was the most numerous and appeared in large numbers after the 23rd April; the measures adopted were trap belts and shaking the beetles from the trees. *Anthonomus pomorum*, L., was present in enormous quantities after 18th April. *Rhynchites pauxillus*,

Germ., was found less frequently, while *R. bacchus*, L., and *R. giganteus*, Kryn., appeared only singly. *Epicometis hirta*, Poda, appeared in the middle of the month and attacked wild plants. *Lethrus apterus*, Laxm., injured raspberries and strawberries in Kupiansk in the middle of the month; *Melolontha hippocastani*, F., was on the wing in large numbers at the end of the month, and *Aporia crataegi*, L., and *Eriophyes ribis*, Nal., which infested buds of black currants, were also reported. Field crops were attacked in the district of Izium by caterpillars of *Oria musculosa*, Hb., while those of *Pyrausta nubilalis*, Hb. (*Botys silacealis*, Hb.), were found in maize stubbles in the same district and in Kupiansk.

Мелкія извѣстія. [Short notes], p. 20.

An outbreak of *Bibio marci*, L., occurred in one locality of the district of Valk at the end of April and later on these insects were noticed over the whole of the government. In another locality of the same district, ash trees were injured by *Hylesinus fraxini*; many of the beetles were killed by a fungus.

Kurbatov (N.). **Дѣятельность Ферганской Агрономической Организаціи въ 1913 году.** [The work of the Ferghana Agronomical Authority in 1913.]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, nos. 3, 4 & 5, March, April and May 1915, pp. 225–243, 323–340 and 421–440.

No organised campaign against insect pests exists over the whole area of the province, this branch of the work being concentrated in the region of Skobelev. Trap belts were successfully applied in orchards, as well as spraying with Paris green against *Cydia pomonella* and other pests and with quassia against aphids. Some 4,000 trees were sprayed, the amount assigned by the Department of Agriculture for these purposes being £125.

Serbinov (I. L.). **Бактеріальныя болѣзни томатовъ.** [Bacterial diseases of tomatoes.]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 5, May, 1915, pp. 343–349.

The author describes two bacterial diseases of tomatoes, "brown rot" caused by *Bacillus solanacearum*, Smith, and another by *Phytobacter lycopersicum*, Groen. Both of these are said to be carried by insects.

Orzhelsky (K.). **По поводу борьбы съ яблонной медяницей окуриваніемъ табачнымъ дымомъ.** [On the control of *Psylla mali* by fumigation with tobacco-smoke.]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture & Market-Gardening*], *Petrograd*, no. 20, 30th May 1915, pp. 604–606.

The author refers to his previous article on this subject [see this *Review*, Ser. A, ii, p. 615] and reports that in the orchards where the fumigation was applied, no imagines of *Psylla mali* were observed during the whole autumn and only a very few eggs were found there in February of the following year. Owing to the rise in price of tobacco dust, he recommends fruit-growers to grow their own tobacco.

The following is taken from an abstract from **« Вѣстникъ Русской Прикладной Энтомологіи.»** [*Messenger of Russian Applied Entomology*], *Kiev*, no. 6, 1915, pp. 174–175.

VASSILIEV (E. M.). **Вредители кукурузы и мѣры борьбы съ ними.** [Pests of maize and measures against them.] **« Южно-русская сельско-хозяйственная газета.»** [*South Russian Agricultural Gazette*], *Charkov*, 1914, nos. 5, 11, 17, 32 & 38, pp. 10–11, 8–10, 14–15, 9–10 & 8–9.

The following ELATERIDAE are injurious to maize and devour the seed, roots and stem of the plants: *Agriotes lineatus*, L., *A. obscurus*, L., *Melanotus punctolineatus*, Pelerin, in Hungary; *Athous hirtus*, Hbst., in Podolia and Bukovina; *Athous niger*, L., and *A. niger*, var. *scrutator*, Hbst., in Kiev. According to Del Guercio, the larvae of these beetles feed from October to May on decomposing organic substances, so that the destruction of weeds in the fields is unimportant. The cultivation of the soil during droughts, when the larvae prepare to pupate between the end of March and the end of April, may have some practical importance in Italy. In Russia, it might be necessary to postpone this cultivation for 1½ or 2 months, as the larvae do not pupate before the end of July. A new enemy of adult Elaterids, viz., the Carabid beetle, *Broscus cephalotes*, L., is recorded. Among the TENEBRIONIDAE, the imago of *Crypticus quisquilius*, L., is injurious in Italy and France, but no damage by it in Russia has been observed. *Tetraneura ulmi*, Deg., attacks many plants, including maize, in its root-form, while the leaf-form lives on elm trees. Against the root form, the root of the stubbles should be burnt *in situ*. Maize should not be sown near elms, nor elms planted near maize. The life-history of *Tetraneura rubra*, Licht., resembles that of *T. ulmi*. Other aphid pests of maize are:—*Pentaphis setariae*, Pass., in Italy; *Aphis zeae*, Rosl., *A. maidis*, Pass., and *A. maidis-radicis*, Forbes, in North America; *A. sorghi*, Theo., and *A. rumicis* (*papaveris*, F.) in Russia; and *A. sorbi*, Kalt, and *A. podi* in the Crimea. The roots of maize are attacked by *Heterodera radicicola*, Greef, and *H. schachtii*, Schmidt.

VASSILIEV (Eug. M.). **Отчетъ о дѣятельности энтомологическаго отдѣленія Мико-Энтомологической Опытной Станціи Всероссійскаго Общества Сахарозаводчиковъ за 1914 годъ.** [Report on the Work of the Entomological Branch of the Myco-Entomological Experiment Station of the All-Russian Society of Sugar-refiners (in Smiela, govt. of Kiev) in 1914], *Kiev*, 1915, 74 pp., figs. [Received 9th June 1915.]

A general review is given of the work done by the Station and by individual members of the staff, some of which has not been completed, owing to the war. The effects of machorka* (tobacco) dust on the surface and subterranean pests of beet was investigated by the author. The dust proved effective against nematodes and flea-beetles and was also more or less effective as a manure. Some experiments

[* МАХОРКА (Machorka) is a cheap and very coarse tobacco now prepared from the leaves of *Nicotiana rustica*, which contain a high percentage of nicotine.—ED.]

on poisoning larvae of *Haltica oleracea* and *Athalia spinarum* with acid lead chromate gave negative results [see this *Review*, Ser. A, iii, p. 109]. The following pests are dealt with in the report :—

Pests of sugar-beet. Coleoptera : *Bothynoderes punctiventris*, Germ., not numerous ; the larvae of *Otiorrhynchus ligustici*, L., which were also found in large numbers on roots of clover ; to the list of the food-plants of this pest [see this *Review*, Ser. A, ii, p. 465] should be added, according to Kirchner, the following :—rye, barley, peas and strawberries ; *Tanymecus palliatus*, F. ; *Liparus coronatus*, Goeze ; *Gastroidea polygoni*, L., is sometimes found on sugar-beet and it is thought that the Histerid, *Saprinus virescens*, Payk., destroys its eggs and larvae. The Silphid, *Thanatophilus sinuatus*, F., has not been previously reported as a pest of sugar-beet, though *T. rugosus*, L., is recorded by Theobald ; the larvae of these beetles were observed to eat seedlings of red beet and of *Chenopodium album* ; a 5 or 6 per cent. solution of barium chloride is very effective against them. According to Petrushtchinsky, *Agriotes lineatus*, L., may be controlled by rolling the soil and by applying kainit and saltpetre. *Pentodon idiota*, Hbst., is included in the list of pests of beet, on the strength of the statement of S. A. Mokrzecki and I. M. Shtchegolev [see this *Review*, Ser. A, i, p. 357]. With regard to *Podonta nigrita*, F., in addition to the author's own observations [see this *Review*, Ser. A, iii, p. 93], it has also been recorded by Portchinsky [see this *Review*, Ser. A, iii, p. 483], by Krassilstchick in Bessarabia, by Uvarov in Stavropol on flowering grain, and by Sochatzky in Kiev, and probably it also occurs in Cherson, Taurida and the province of the Don.

Lepidoptera : *Phlyctaenodes sticticalis* appeared very early, on 12th May, but was not numerous. *Phytometra* (*Plusia*) *gamma*, L., occurred in small numbers in the middle of September ; its caterpillars were largely infested with *Litomastix truncatellus*, Dalm., and its eggs by *Telenomus phalaenarum*, Nees. According to Standfuss, they are also infested with the fungi, *Empusa muscae*, Cohn, and according to Ludwig, by *Empusa plusiae*, Giard, which is carried by a mite, resembling *Tyroglyphus mycetophagus*. *Acronycta rumicis*, L., is recorded as a pest of sugar-beet on the strength of the statement of Ochsenheimer ; in the Baltic provinces there is only one generation of these insects, the moths being on the wing in May and June. In the greater part of Europe, in Siberia and Central Asia, there is a second generation in July and August, while in Bukovina there are three generations, in April, June and August.

Rhynchota : *Eulecanium robinarium*, Douglas, was only observed in small numbers, probably owing to its numerous enemies and parasites, which include the beetle, *Anthribus variegatus*, Geoffr. (*varius*, F.), and the Chalcids, *Coccophagus scutellaris*, Nees, and *Aphelinus* (*Coccobius*), *scutellaris*, Dalm. The eggs of *Aphis rumicis* (*papaveris*, F.) winter on *Viburnum opulus*, *Philadelphus coronarius*, *Euonymus europaea* and *E. japonica*, but in warm winters may also occur on beets remaining in the field after the harvests. The aphids do not appear on beet before May. *Macrosiphum circumflexum*, Buckton, occurred on beet grown in the laboratory. Figures of wingless and winged viviparous females of this species are given. *Adelphocoris lineolatus*, Goeze, and *Lygus pratensis*, L., var. *campestris*, Fall., were observed in August to be feeding on the flower buds of a

species of *Malva*, a new food-plant for the former insect; *L. pratensis* is believed to hibernate as an imago. The Tingid, *Piesma capitata*, Wolff, was observed on flowers of *Reseda*.

Pests of other cultivated plants included:—*Opatrum sabulosum*, L.; *Meligethes aeneus*, F., which occurred on wheat and also, according to Petrushtchinsky, was very destructive to the blossom of rye; *Anomala aenea*, De Geer, (*frischi* F.) occurred on vine leaves; *Lema melanopus*, L., in trenches round a beet plantation; *Crioceris merdigera*, L., on asparagus and onions, and *Psylliodes* sp. on vines. *Otiorrhynchus ligustici*, L., injured roots of red clover. The Aphodiid, *Rhyssemus asper*, F. (*germanus*, auct.), occurred on lucerne and clover. Larvae of *Chaetocnema hortensis*, Geoffr. (*aridella*, Payk), were found in a stem of barley in 1911, so that at least two species of this genus live in the stems of barley, the other being *C. aridula*, Gyll., [see this *Review*, Ser. A, ii, p. 172].

Lepidopterous pests included:—*Pyrausta nubilalis*, Hb., which was very abundant in the government of Kiev, maize being much more frequently injured than millet. Some 15 acres of maize in one estate were injured in August by the caterpillars, the upper part of the stem being chiefly attacked; only single cases of injury were noticed in the cobs. Larvae of *Episilia* (*Agrotis*) *simulans*, Hufn., were found in fields of winter rye; in the laboratory the caterpillars readily ate winter wheat, sugar-beet, oats and barley. Caterpillars of the Geometrid, *Chloroclystis rectangulata*, L., were collected in the orchard of the Station, where they injured the foliage of pear trees. *Gracilaria syringella*, F., was more injurious in Smiela than in the previous year. The eggs of the first generation are laid on the lower side of leaves of lilac, but the author has never found them in the buds, as stated by Sorauer, nor on the petioles of the leaves, as stated by Guenaux. *Pieris brassicae*, L., was infested with *Omorgus mutabilis*, Holmgren, from a cocoon of which some hyperparasites were reared, but not identified.

Rhynchota: *Lepidosaphes ulmi*, L., was found in the middle of June on the fruits of apples, as much as 30 mm. in diameter. *Aphis idaei*, Goot, occurred in May on the tips of raspberry canes and in less numbers on the petioles of the leaves of plums. *Siphonophora caraganae*, Cholodkovsky, was observed on young fruits of Caragana (Siberian pea-tree). *Aleurochiton aceris*, Geoffr., was frequently found on the lower side of leaves of the common maple, causing the leaves to wither.

Hymenoptera: The life-history of *Athalia spinarum*, F., has been studied at the station by V. M. Kostinsky. The females oviposit inside the leaves of mustard, *Sinapis arvensis* and *Sisymbrium sophia* (not on the leaves, as stated by Kulagin, nor along the veins, as stated by Sacharov); the egg stage lasts 5 or 6 days; the larval stage lasting 9 or 10 days in June and July, 13 to 15 days in August and 26 to 30 days in September; when mature, the summer generations pass into the earth and build cocoons in which they remain for 6 to 8 days before pupating, the pupal stage lasting 8 or 10 days. The winter is passed in cocoons in the larval stage. Remedies recommended by various authors, include the collection of the larvae; reploughing the soil in autumn; powdering the plants with soot; dusting with lime while the morning dew is still present; early sowing of summer

rape, or alternately, the cultivation of winter rape: trap strips sown with *Sinapis arvensis* (charlock); spraying with kerosene and soap, Paris green or barium chloride.

Among Dipterous pests, *Oscinella frit*, L., injured the seedlings of winter crops in the district of Tcherkassi. *Phytomyza* sp., probably *albiceps*, Meig. (*pisi*, Kalt.), was observed in the larval stage on leaves of peas in April in the government of Charkov. Mines thought to have been due to *P. geniculata*, Macq., were observed in the parenchyma of cucumber leaves.

The following list of pests of onions and garlic is given. Coleoptera: *Agriotes lineatus*, L., *Brachylacon murinus*, L., *Pentodon idiota*, Hbst., *Melolontha melolontha*, L., *M. hippocastani*, F., *Crioceris merdigera*, L., *Brachycerus algirus*, F., *B. undatus*, F., *B. barbarus*, F. Lepidoptera: *Pieris brassicae*, L., *P. napi*, L., *Euxoa* (*Agrotis*) *segetum*, Schiff., *Feltia* (*Agrotis*) *exclamationis*, L., *Laphygma* (*Caradrina*) *exigua*, Hb., *Phlyctaenodes sticticalis*, L., *Acrolepia assectella*, Z., *Eupithecia* (*Tephroclystia*) *alliaria*, Stgr. Diptera: *Hylemyia antiqua*, Meig., *Chortophila brassicae*, Bouché, *C. fusciceps*, Zett., *C. furcata*, Bouché, *C. cilicrura*, Rond., *Drosophila phalerata*, Meig., *Eumerus strigatus*, F., (*aeneus*, Macq.), *Tipula oleracea*, L. Hemiptera: *Aphis allii*, Lichtenst. Thysanoptera: *Thrips tabaci*, Lind. Acarina: *Rhizoglyphus echinopus*, Murray. Nematoda: *Tylenchus devastatrix*, Kuhn.

The Cryptophagid, *Leucohimatium langi*, Solsky, was found on millet infested with *Ustilago panici miliacei*, Wint., on 30th July, the beetles being inside the envelope of the fungus; they were also found on a vine leaf infested with *Plasmophora viticola*; there seems to be no doubt that these beetles feed on fungi and probably are concerned in their distribution.

Zibold (F. I.). **Лѣсныя культуры на Θеодосійскихъ горахъ.** [Afforestation of the mountains of Theodosia.]—**«Труды по лѣсному опытному дѣлу въ Россіи.»** [*Memoirs on Forestry-Research Work in Russia*], published by the Forestry Department of the Central Board of Land Administration and Agriculture, *Petrograd*, 1915, liii, 114 pp., 9 plates, 2 maps.

Prior to 1897, black pine trees in Crimean forests were injured by caterpillars of *Rhyacionia* (*Retinia*) *buoliana*. Since that date the following pests have been recorded:—Young oaks were frequently attacked by pests, such as *Phalera bucephala*, L., more or less considerable outbreaks of which occurred nearly every year in the second half of the summer. *Zeuzera pyrina*, L., as well as *Cerambyx* and *Purpuricenus*, also did damage. Owing to the fact that in the Theodosia mountains the mountain maple bears fruit when very young, and is also attacked by the fungus, *Rhytisma acerinum*, it is so much weakened that it falls an easy prey to *Agrilus viridis*, L. Young maples attacked by this pest almost invariably die, while in the case of large outbreaks older and healthy trees are damaged. It was first observed in 1904, and the cutting and burning of the infested trees seems to be the only practicable remedy. The acute-leaved maple (*Acer acuminatum*) is less subject to attack by these pests. Elm trees were frequently attacked by *Phalera bucephala*, without, however, suffering great injury. Pear

trees, as well as medlars, which grow there wild, are much selected by *Euproctis chrysorrhoea* for oviposition and their foliage is frequently destroyed in spring in consequence. *Euonymus europaeus* (dog wood), suffered during the spring of 1914 from the caterpillars of *Hyponomeuta euonymellus*, Scop.

QUAINTANCE (A. L.). **Remarks on some Little-known Insect Depredators.**—*Science, Philadelphia*, xli, no. 1068, 18th June 1915, p. 916.

A species of Jassid, *Typhlocyba obliqua*, is at the present time seriously destructive to apples in parts of the Ozark mountain region and in Kansas. The insects occurred abundantly on the lower side of the leaves, causing the foliage to drop, with subsequent injury to the fruit crop. A Microlepidopteron, *Marmara* sp., was reported to have caused injury in apple orchards in Virginia. The larva makes long tunnels under the skin, resulting in the decay of the fruit. The stick insect, *Diapheromera femorata*, occasionally becomes a pest in orchards which are adjacent to woodlands. A Chrysomelid beetle, *Rhabdopterus picipes*, feeds in the larval state on the roots of cranberry. Observations on this insect show that it is restricted to cranberries growing in fairly high, sandy soils. The Pentatomid bug, *Nezara hilaris*, has recently become destructive to peaches in northern Ohio. The larva of the Longicorn, *Parandra brunnea*, frequently injures the heartwood of old apple trees, with the result that the trees are often blown over by the wind. A new midge pest, *Contarinia johnsoni*, has, during recent years, become well known on account of its injury to grapes. The adults deposit from 10 to 70 eggs in the flower buds, many of which are thus destroyed by the larvae.

COAD (B. R.). **Relation of the Arizona Wild Cotton Weevil to Cotton Planting in the Arid West.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 233, 27th May 1915, 12 pp., 4 plates.

Cotton culture was introduced into Arizona under irrigation conditions. It was hoped that the establishment of important insect pests could be prevented by quarantines, and this was rendered possible by the complete isolation of the new territory. It has been found, however, that *Anthonomus grandis thurberiae*, nearly identical with *Anthonomus grandis*, Boh. (the Mexican cotton-boll weevil), occurs on *Thurberia thespesioides*, a wild cotton plant so closely related to cotton that some investigators have placed it in the genus *Gossypium*. The plant seems to be particularly concentrated in the mountain ranges surrounding Tucson. The weevil may transfer its attacks to cultivated cotton in the Santa Cruz and Rillito Valleys at an early date. Its present habits are such that it would not greatly injure cotton, but a change to more injurious habits is probable. At present this weevil does not emerge in autumn, but remains sealed up in a cell formed in the midst of the seeds in the boll and passes the winter in this condition. In the spring, instead of becoming active with the first warm weather, as the cotton weevil does, the greater number of them remain sealed in the cell until the rains late in the summer, many not emerging until August. This is simply a case of prolonging

the period of hibernation into one of aestivation, a habit often observed among species living in arid regions. More or less moistening of the weevil cell is necessary to allow emergence in most cases. A scattered emergence may be expected throughout the spring and summer months, the extent of this emergence depending upon the amount of the precipitation; almost complete emergence follows the heavy rains of July and August. In the greater part of the mountain region there are therefore not more than two generations annually, instead of the six to eight of the cotton weevils. If this cell hibernation habit is maintained, the control should be quite simple, entailing only the winter destruction of the plants and hibernating weevils. A careful watch should be maintained for the appearance of the pest on cultivated cotton.

MOORE (W.). *Alabama argillacea* **in Minnesota.**—*Science, Philadelphia,* xli, no. 1067, 11th June 1915, p. 864.

Alabama argillacea appeared in Minnesota during the past season at several different places. The first recorded appearance was on the 21st September, when considerable injury to strawberries was reported. Several other attacks were noted during October. These observations show the northern flight of the moth and emphasise the fact that it will feed on fruit if it is available.

WASHBURN (F. L.). **The Cotton Worm Moth in Minnesota (Lep.)**—*Entom. News, Philadelphia,* xxvi, no. 5, May 1915, p. 207.

Alabama argillacea (the cotton worm moth) appeared in large numbers last autumn in the latitude of St. Paul. A little damage was done to late-bearing strawberries, and much alarm caused to growers, because the moths attacked the fruit itself. This was the first occurrence, known to the author, in the last thirteen years of this moth in this latitude in Minnesota.

FISHER (W. S.). **One new Genus and two new Species of Cerambycidae.**—*Proc. Entom. Soc. Washington, Baltimore,* xvii, no. 2. June 1915, pp. 77–79.

Hylotrupes juniperi, sp. n., was taken from the heartwood of a juniper. The larval burrows follow the grain of the wood, half in the bark and half in the sapwood. When full grown, the larvae pass into the heartwood to pupate. *H. amethystinus*, Lec., has a similar habit, but only attacks dying and felled *Libocedrus* and *Thuja*. *Paratimia conicola*, gen. et sp. n., which is also described, was taken from cones of *Pinus attenuata*.

GREEN (E. E.). **Observations on British Coccidae in 1914, with descriptions of new species (concluded)**—*Entomologists Mthly. Mag., London,* no. 613, June 1915.

Kuwanina parvus, Mask., found on cherry trees imported from Japan, of which country it is a native, is described. It is apparently able to thrive in the open in England and may prove of economic importance. *Aulacaspis* (*Diaspis*) *pentagona*, Targ., has also been detected on cherry trees imported from Japan.

Raspberry Canes diseased.—*Gardeners' Chronicle, London,* lvii, no. 1485, 12th June 1915, p. 336, 1 fig.

Raspberry canes have been found infected by *Incurvaria* (*Lampronia*) *rubiella* (the raspberry moth). As the larvae pass the winter in the ground at the roots of the plants, it is advisable to remove old stakes and the soil at the roots and to spread soot, lime and ashes round the base of the canes. After a bad attack, the canes should be cut back and the affected parts burned. Smearing the lower parts of the canes with soft soap during March is also recommended.

Cameron (A. E.). **Potato Spraying and Dusting in New Jersey, U.S.A.** —*Bull. Entom. Research, London,* vi, 1st June 1915, pp. 1–21, 2 figs., 3 plates, 7 tables.

Experiments with various fungicides and insecticides carried out in New Jersey were intended to demonstrate the means by which a larger yield of potato tubers per acre might be procured by the employment of scientific methods of spraying and dusting. The following insects were present in the fields under treatment:—*Epitrix cucumeris, E. fuscula, Epicauta vittata,* a few aphids (*Rhopalosiphum solani*), and the Colorado beetle (*Leptinotarsa decemlineata*). Bordeaux mixture proved to be an excellent fungicide and also an effective insecticide when arsenate of lead was added. Both Colorado and flea-beetles were better controlled by the Bordeaux-lead arsenate mixture than by any other insecticide used. The mixture acts as a plant stimulant by maintaining the green colour of the leaves for a longer period. Thoroughness of application and repetition of treatment at least once in every 10 days are necessary. Care in the preparation of the mixture is advised. Sufficient lime must be used to ensure that all the copper sulphate is changed to the hydrated form, otherwise scorching of the leaves may ensue. The use of the mixture may increase the value of the yield of tubers from £3 to £5 per acre. Various proprietary mixtures proved less economical and less efficient than the home-made article. Sulphur did not realise expectations as a crop stimulant. Concurrent experiments carried out in field and laboratory led to the discovery of a special insecticide for the flea-beetle. It was composed of pyrethrum infusion, gelatin or soap, and lead arsenate. Further experiments in this direction are necessary. The fenestration of the leaves by the flea-beetle reduces the assimilating surface and renders the tissue more susceptible to the attacks of fungi. A Braconid parasite (*Perilitus epitricis*) of the flea-beetle was reared from the adult. Its behaviour in relation to its host was observed. No figures were obtained of the percentage of parasitism, but it is considered that the Hymenopteron is practically a negligible factor in control.

Green (E. E.). **On a new Species of *Lecanium* from Northern Nigeria.** —*Bull. Entom. Research, London,* vi, 1st June 1915, p. 43, 1 fig.

A description is given of *Lecanium catori,* sp. n., found on kola-nut pods in Kabba Province, Nigeria. The same pods were also infested with *Stictococcus sjöstedti.*

Green (E. E.). **Notes on Coccidae collected by F. P. Jepson, Government Entomologist, Fiji.**—*Bull. Entom. Research, London,* vi, 1st June 1915, p. 44.

The bulk of the collection consisted of a form intermediate between *Aspidiotus destructor* and *A. transparens*, which the author considers to be merely extreme forms of a single species. It infests *Musa*, *Persea* and *Piper* in Fiji. *A. excisus*, hitherto recorded from Ceylon only, is recorded on *Musa* in Fiji. The collection also included the following:—*Aspidiotus cyanophylli*, Sign., on *Musa*; *Aspidiotus palmae*, Ckll., on *Musa* and an undetermined forest tree; *Aspidiotus lataniae*, Sign., on *Citrus*; *Aspidiotus hartii*, Ckll., on *Dioscorea*; *Chionaspis citri*, Comst., on *Citrus*; *Chionaspis dubia*, Mask., on *Adiantum* fern; *Hemichionaspis minor*, Mask., on foliage of Eucharis lily; *Aulacaspis pentagona*, Targ., on *Hibiscus*; *Lecanium* (*Saissetia*) *nigrum*, Nietn., on *Anthurium*; and *Asterolecanium miliaris-longum*, Green, on *Schizostachium* (a bamboo).

Green (E. E.). **New Species of Coccidae from Australia.**—*Bull. Entom. Research, London,* vi, 1st June 1915, pp. 45–53, 13 figs.

The following new species of Coccidae are described:—*Eriococcus serratilobis*, sp. nov., on *Eucalyptus gracilis*; *E. serratilobis prominens*, subsp. nov., on an undetermined plant; *Rhizococcus lobulatus*, sp. nov., on *Acacia pendula*; *Rhizococcus lecanioides*, sp. nov., on *Casuarina*; *Asterolecanium stypheliae*, Mask., var. *multiporum*, nov., on *Samolus repens*; *Pulvinaria maskelli*, Olliff, var. *novemarticulata*, nov., on *Hymenanthera dentata*; *Chionaspis frenchi*, sp. nov., on *Eucalyptus*; *Chionaspis angusta*, Green; *Aspidiotus tasmaniae*, sp. nov., on *Ribes*, *Ampelopsis*, *Eucalyptus*, *Acacia* and *Cytisus*; *Aspidiotus* (*Hemiberlesia*) *bidens*, sp. nov., on *Casuarina*; *Aspidiotus* (*Targionia*) *cedri*, sp. nov., on cedar logs; *Mytilaspis* (*Fernaldella*) *beyeriae*, sp. nov., on *Beyeria viscosa*; *Protodiaspis anomala*, sp. nov., on *Acacia*, sp.

Caesar (L.). **Losses caused by Insects.**—*Canadian Horticulturist, Peterboro, Ont.*, xxiii, no. 5, May 1915, p. 138.

Insect injury does not exceed 5 per cent. in many sprayed Ontario orchards, whilst in unsprayed orchards, especially in the Niagara district and the warmer parts of the province, the loss may amount to as much as 80 or even 90 per cent.

Ehrhorn (E. M.). **Report of the Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu,* xii, no. 5, May 1915, pp. 121–123.

In March 1915, 32 imported packages of fruit and 14 of vegetables were destroyed by burning. Rose aphis was found on rose plants. *Coccus hesperidum*, *Pseudococcus pseudonipae* and *Cerataphis lataniae* were found on ornamental plants and palms from Florida. Two plants of *Warneria thunbergia* were badly infested by *Aleurodes citri* (citrus whitefly) bearing its fungus, *Aegerita webberi*. Mr. Fullaway

reports that the insectary liberated the following beneficial insects: 781 *Diachasma fullawayi* females and accompanying males, 28 *D. tryoni* females and accompanying males, and 9,200 *Tetrastichus giffardi.*

Bentley (G. M.). **Suggestions for the Control of Injurious Insects and Plant Diseases.**—*Univ. Tennessee Agric. Expt. Sta., Knoxville,* Bull. no. 106, June 1914, 25 pp., 4 figs. [Received 25th May 1915.]

This bulletin contains suggestions as to the control of insect and fungus pests by cultural methods, beneficial insects, birds, insecticides and fungicides. A number of formulae are given together with directions for making them up.

The Pine-Shoot Moth.—*Amer. Forestry, Washington, D.C.,* xxi, no. 5, May 1915, pp. 637–640, 7 figs.

The importation of pine trees from Europe after 1st July 1915, has been forbidden by the Department of Agriculture under a quarantine order. This action has been taken to protect American pine trees from the pine shoot moth (*Rhyacionia buoliana*), which is so injurious in Europe, and has been found in a few localities in the United States [see this *Review*, Ser. A, iii, p. 376].

Glaser (R. W.). **Wilt of Gipsy Moth Caterpillars.**—*Jl. Agric. Research Washing'on, D.C.,* iv, no. 2, May 1915, pp. 101–128, 17 figs. 4 plates.

This investigation of the wilt of *Lymantria* (*Porthesia*) *dispar*, L., (gipsy moth) caterpillars was undertaken in the hope of obtaining results of economic importance. The wilt, first recorded in the United States in 1900, is a true infectious disease distributed over the entire infested territory. Epidemics occur only in heavily infested localities. Climatic conditions appear to bear an important relation to wilt in the field, and it has been shown experimentally that sunlight can convert the chronic into the acute form of wilt. Older caterpillars suffer more than younger ones, but small individuals also die of the disease in the field. Infection naturally takes place through the mouth by means of the food. Some of the imported parasites may be important factors in aiding the dispersion of this disease, which is probably transmitted from one generation of caterpillars to another, although no definite evidence on this point is as yet available. A bibliography of 18 works is given.

Chittenden (F. H.). **The Violet Rove-Beetle.**—*U. S. Dept. Agric., Washington, D.C.,* Bull. no. 264, 15th June 1915, 4 pp., 1 fig.

Since 1901, a small dark-coloured rove-beetle, *Apocellus sphaericollis*, Say, has been reported as an enemy to violets and other succulent ornamental plants in the District of Columbia and from St. Louis, Mo. The complaints cover a period of 12 years and some of the many records of injuries by ants in greenhouses are probably due to this insect, which closely resembles *Tetramorium caespitum*, L. (pavement

ant) often found in greenhouses. Originally described by Say in 1834 as *Lathrobium sphaericolle*, this Staphylinid, which measures about $\frac{1}{10}$ inch in length, is the sole representative of its genus in the United States. Violets, lilies, dahlias, pansies, forget-me-nots and other soft plants are attacked. The grower who first complained of injury was advised to use decaying leaves, deposited in piles at regular intervals about infested violet plants. This attracted the beetles and they were killed by dipping the leaves into hot water, the leaves afterwards being restored to the traps. Four years after the first occurrence of this insect on hothouse violets, it had disappeared as a pest, the grower reporting that he had used spinach, kale and chickweed as traps, as advised. In the same year another grower stated that at least three of his pansy beds had been cleared of the beetles by dusting them with tobacco, although in adjoining beds they were nearly as plentiful as before treatment. Injury by *A. sphaericollis* is undoubtedly preventible by care in looking over the soil, or the dead leaves used as a mulch in violet or pansy beds. Sterilisation of this material would prevent the greenhouse or flower beds from being infested.

Surface (H. A.). **A New Pear Insect in Pennsylvania.**—*Zool. Press Bull., Penns. Dept. Agric., Harrisburg*, no. 317, 24th May 1915.

The destructive pear midge (*Contarinia pyrivora*), which was introduced into Connecticut about 40 years ago and has gradually spread into New York and New Jersey, is now reported from Pennsylvania for the first time. French pear trees are chiefly attacked, while the Seckel and Bartlett varieties do not appear to be much affected. As a means of control, shallow cultivation is recommended during June and July. This will destroy the pest in its earthen cell, as it does not descend more than an inch or two. The infested pears, known by their enlarged condition, should be collected and burnt without delay. On sandy soils, such as those in New Jersey, from 1,000 to 2,000 lb. of kainit per acre has been effective in destroying them in the ground, but this cannot be advised for all soils, as the trees may be injured. Spraying is useless, because the eggs are laid by punctures made through the unopened blossoms.

Gray (R. A. H.). **The Prevention of Egg-laying on Turnips by the Diamond-back Moth.**—*Jl. Bd. Agric., London*, xxii, no. 3, June 1915, pp. 222–226.

The presence of *Plutella maculipennis* (diamond-back moth) amongst turnips was reported early in the summer of 1914. A later report on 17th June from Belford, Northumberland, stated that the moths were abundant among turnips and potatoes. The occurrence of the moth in large numbers at more or less distant intervals is apparently dependent on weather and food conditions; the number of overwintering pupae is greatly reduced by excessive rain and wind. Infestations are very local, hence any efficient methods of control, applied at the beginning of an outbreak, should have the effect of saving the crop. Test substances were applied on 23rd June and

examinations made for several consecutive days following. It was found that paraffin and sand, in the proportion of $1\frac{1}{2}$ pts. paraffin to 1 bushel of sand, spread over and round the turnips at the rate of 6 cwt. per acre, and ground lime at the rate of $2\frac{1}{2}$ cwt. per acre, gave good results in preventing oviposition. The application of paraffin and sand had however to be repeated, whereas a single application of ground lime was sufficient. The foliage suffered no injury. When the larvae were on the leaves, the best results were obtained by brushing the leaves by means of a "scuffler" to which branches were attached. The plan was adopted of fixing a pole in front of the scuffler with two bags containing sand and paraffin hanging from the pole on each side in such a way that the bags brushed four drills of turnips. It was noted that plants singled when small, suffered more than those which were singled later. Starlings and plovers proved useful in one infested field. At West Hartlepool, coke fires attracted large numbers of moths at night.

Reports on Insects of the Year.—*45th Ann. Rept. Entom. Soc. of Ontario, 1914. Toronto*, 1915, pp. 13–28, 2 figs.

In the Ottawa district serious outbreaks of certain well-known insects occurred during the growing season of 1914. *Cirphis* (*Leucania*) *unipuncta* (army-worm) was particularly abundant in the Carp and Kinburn districts. *Melanoplus atlantis* attacked barley, oats, and timothy. Cutworms, belonging to the species, *Euxoa tessellata*, *E. messoria*, *E. ochrogaster* and *Sidemia* (*Hadena*) *devastatrix* were present in many localities. Root maggots were found on radishes, onions, cabbage and cauliflower; the last two vegetables were protected by means of tarred paper disks placed round them at the time of planting out. *Psila rosae* (carrot rust fly) was found in a private garden in Ottawa. Spraying with kerosene emulsion, 1 part in 9 of water, has been found useful in controlling this insect; applications should be made once a week during June and the first half of July. *Papilio polyxenes* (celery caterpillar) was found attacking parsley early in July. *Plutella maculipennis* (diamond-back moth) was very abundant in cabbage fields in the latter half of June. Two species of tent caterpillars (*Malacosoma americana* and *M. disstria*) were present in many localities. *Eriocampoides limacina* (pear slug) was abundant in orchards on plum and cherry trees. *Typhlocyba rosae* (rose leaf-hopper) infested the foliage of roses throughout the district. *Hoplocampa* (*Emphytus*) *canadensis* (violet sawfly) was found in the middle of June on pansies: the larvae were destroyed by dusting the plants in the evening with white hellebore or with Paris green mixed with 50 times its weight of flour. *Lygus pratensis* (tarnished plant bug) was destructive to dahlias. *Pionea* (*Phlyctaenia*) *rubigalis* (green-house leaf-tier) and red spider were responsible for damage to many kinds of plants. In the Orillia district, the appearance of two asparagus beetles, *Crioceris asparagi* and *C. 12-punctata*, was noticed. *Agrilus ruficollis* (raspberry cane borer) appeared in some districts. In the northern part of Toronto, *Hylemyia antiqua* (*Pegomyia cepetorum*) (onion maggot) was present. *Poecilocapsus lineatus* (four-lined plant bug) occurred in large numbers on dahlias. In the Niagara district, the following orchard pests were recorded:—*Rhagoletis pomonella*

(apple maggot), *Aphis* spp., *Conotrachelus nenuphar* (plum curculio), *Psylla pyricola*, *Empoasca mali* (apple leaf-hopper), *Samia cecropia*, *Tetranychus pilosus*, *Rhagoletis cingulata* (cherry fruit fly), *Haltica chalybea* (grape flea-beetle), *Monophadnus* (*Monophadnoides*) *rubi* (raspberry sawfly), *Pteronus ribesii* and *Myzus ribis* (currant aphid). Field crops were attacked by *Macrosiphum pisi* (pea aphis), *Cirphis unipuncta*, *Crioceris asparagi*, *C. 12-punctata*, *Anasa tristis* (squash bug), *Diabrotica vittata* (cucumber beetle), *Leptinotarsa decemlineata* (potato beetle) and *Pieris rapae*. Black walnut trees were in some cases almost defoliated by *Datana integerrima*, and the larvae of *D. ministra* were found on American elm and basswood trees. Scotch elms were attacked by *Eriosoma* (*Schizoneura*) *ulmi* and *Tetraneura ulmisacculi*. *Cyllene robiniae* (locust borer) was very abundant during August. *Phyllaphis fagi* was present in injurious numbers on the copper beech.

PETCH (C. E.). **Insects injurious in Southern Quebec, 1914.**—*45th Ann. Rept. Entom. Soc. of Ontario, 1914. Toronto*, 1915, pp. 70–71.

Tent caterpillars [*Malacosoma* sp.] were very abundant over the entire province. Some of the pupae were attacked by a Hymenopterous parasite. Late in September, *Datana ministra* (yellow-necked apple-tree caterpillar) was found defoliating basswood trees. The larvae of *Pieris* (*Pontia*) *rapae* were common wherever cabbages were grown. Outbreaks of *Cirphis* (*Leucania*) *unipuncta* (army-worm) were reported from two localities. *Eucosma* (*Tmetocera*) *ocellana* (bud-moth) was prevalent in apple orchards and *Rhagoletis pomonella* was abundant in several localities. *Lepidosaphes ulmi* (oyster-shell scale) was found on the fruits of apple and plum and terrapin scale [*Eulecanium nigrofasciatum*] on *Prunus americana* and on the butternut. *Typhlocyba comes* (grape leaf-hopper) was recorded from three localities. *Eriosoma lanigerum* was prevalent in wounds and under cankered areas; the winged form was captured in large numbers by tanglefoot bands. *Ceresa bubalus* (buffalo tree-hopper) caused serious injury to young apple trees. Potatoes were attacked by flea-beetles and Colorado potato beetles. *Chrysobothris femorata* (flat-headed apple-tree borer), *Anthonomus quadrigibbus* (apple curculio), *Conotrachelus nenuphar* (plum curculio) and *Anthrenus scrophulariae* (buffalo carpet beetle) were reported from various districts.

BAKER (A. W.). **The Army Worm in Ontario in 1914.**—*45th Ann. Rept. Entom. Soc. Ontario, 1914. Toronto*, 1915, pp. 75–95, 6 figs.

The outbreak of *Cirphis unipuncta* in Ontario was first reported on 14th July in Brant County. Later reports showed that the pest was generally distributed throughout Old Ontario, with the exception of the eastern counties. An account of the life-history and feeding habits is given. The following parasites were reared from this pest during 1914:—TACHINIDAE: *Phorocera* (*Euphorocera*) *claripennis*, *Wagneria* (*Phorichaeta*) *sequax*, *Winthemia quadripustulata*; ICHNEUMONIDAE: *Ichneumon canadensis*, *I. jucundus*, *Paniscus geminatus*,

Mesochorus vitreus ; BRACONIDAE : *Apanteles militaris, Apanteles* sp., *Meteorus communis* ; CHALCIDOIDEA : *Eupteromalus* sp. In the discussion following the paper, Mr. King stated that, in Missouri, army-worms were abundant in 1913 and 1914, appearing especially early in the wheat crops ; they were always preceded by large numbers of bobolinks and red-winged blackbirds. In the post-holes dug for the control of the pest, many *Calosoma* beetles were found and were sent to New Mexico for the control of the range caterpillar. According to Mr. Gibson, the sudden increase in the numbers of the army-worm is probably correlated with the numbers of parasitic enemies and weather conditions. So far as is known, the winter is passed in an immature larval stage.

GIBSON (A.). **Experiments with Poisoned Bran Baits for Locust Control in Eastern Canada.**—*45th Ann. Rept. Entom. Soc. Ontario, 1914. Toronto,* 1915, pp. 97–102, 1 fig.

In the discussion following the paper [see this *Review*, Ser. A, iii, p. 368], the President mentioned that experiments were being carried on in the use of *Coccobacillus* as a means of control for locusts in Canada. Up to the present no definite results had been obtained ; failure was due to the fact that the culture had to be taken from Quebec to Ottawa and did not remain in a viable condition for more than 48 hours. This method of control has been successfully used in the Argentine and in North Africa. Prof. Caesar stated that the Kansas remedy had been satisfactory ; the use of 2 gals. water instead of 3 gals. had seemed preferable. Twenty pounds of the bait was sufficient for five acres. In Manitoba, no results had been obtained when the temperature was below 50° ; in the same province the use of sawdust and salt instead of bran was being tested.

CROSBY (C. R.) & MATHESON (R.). **An Insect Enemy of the Four-lined Leaf-Bug** (*Poecilocapsus lineatus*, **Fabr.**).—*Canadian Entomologist, London, Ont.*, xlvii, no. 6, June 1915, pp. 181–183, 4 figs.

On 26th July 1913, the eggs of *Poecilocapsus lineatus*, F., deposited in stems of *Weigelia* were found to be attacked by a Chalcidoid larva. *Cirrospilus ovisugosus*, sp. n. The larva burrows through the pith of the host plant until it reaches a row of eggs and then proceeds to destroy them. About 50 per cent. of the egg-masses in the clump of *Weigelia* examined were attacked by the parasite. The larvae reach maturity before winter, but do not pupate until the following spring. To secure adults, egg-masses were collected on 28th February 1914 ; the larvae attacking these pupated about a week later and adults emerged on 23rd March. A description of the species is given.

SANDERS (G. E.). **Carnivorous Habits of** *Xylina bethunei*.—*Canadian Entomologist, London, Ont.* xlvii, no. 6, June 1915, pp. 183–184.

In studying *Graptolitha* (*Xylina*) *bethunei* (apple worm) in Nova Scotia in 1913, it was found that the best place to collect 5th and 6th stage larvae was in the leaves about the cocoons of *Malacosoma disstria*.

Several larvae were found in the act of eating into the cocoons or devouring the contained pupae. On 8th, 9th and 10th July 1913, 28·12 per cent. of the cocoons collected had been attacked by the 5th and 6th stage larvae. A later collection gave 34·82 per cent. injured or destroyed pupae. In 1913, *G. bethunei* was thus a considerable factor in the control of *M. disstria.* In 1914, both *M. disstria* and the host plants were retarded by the season and *G. bethunei* was not so numerous as in 1913, nor was it retarded by weather conditions, consequently the majority had pupated before the cocoons of *M. disstria* were formed, and the proportion of cocoons destroyed was only about 6 per cent.

HERRICK (G. W.) & LEIBY (R. W.). **The Pupal Instar of the Fruit-Tree Leaf-Roller** (*Archips argyrospila*).—*Canadian Entomologist, London, Ont.*, xlvii, no. 6, June 1915, pp. 185–187, 2 tables.

Cacoecia (*Archips*) *argyrospila* (fruit-tree leaf-roller) has been very abundant in New York State during the past three years. In 1914, it was determined to study certain phases in the life-history, especially the length of the pupal period. Larvae collected from infested orchards in Western New York were placed in an open-air insectary under normal conditions of temperature. The minimum length of the pupal stage was found to be 9 days and the maximum length 16 days, while the average was 12·6 days. The minimum temperature recorded was 44° F., the maximum, 92° F. The length of the pupal stage recorded under insectary conditions in California varied from 9 to 12 days ; this statement was based on a small number of pupae only.

Sprays that yield Profitable Returns.—*Canadian Horticulturist, Peterboro, Ont.*, xxxviii, no. 6, June 1915, p. 149.

The following sprays are recommended for use in apple orchards :—(1) When the leaves are unfolding ; lead arsenate paste, 5 lb., concentrated lime-sulphur, 4 gals., water, 100 gals. (2) Immediately before flowering ; lead arsenate paste, 5 to 7 lb., concentrated lime-sulphur, 3 gals., water, 100 gals. (3) Immediately after flowering; lead arsenate paste, 5 lb., concentrated lime-sulphur, $2\frac{3}{4}$ gals., water, 100 gals. ; this should be repeated after an interval of ten to fourteen days and further repeated in the case of tender varieties after the same interval.

Currants and Gooseberries.—*Canadian Horticulturist, Peterboro, Ont.*, xxxviii, no. 6, June 1915, p. 150.

Currant and gooseberry bushes are frequently attacked by the San José and European fruit scales. They should be sprayed before growth starts with strong lime-sulphur. As the leaf-buds are opening, an application of dilute lime-sulphur or Bordeaux mixture and 2 lb. lead arsenate to 50 gals. should be made. This spray is repeated when the fruit is about one-quarter grown. Pyrethrum or hellebore may be used later. Aphids or leaf bugs may be controlled by a nicotine spray, applied before the leaves have become curled. The cane borer [*Aegeria tipuliformis* ?] may be eradicated by thorough pruning.

GUPPY (P. L.). **The Syrphid Fly.**—*Dept. Agric., Trinidad and Tobago, Port-of-Spain.* Circ. no. 2, May 1915, 2 pp., 1 fig.

This circular contains notes for the guidance of planters in dealing with supplies of eggs and adults of the Syrphid fly [*Salpingogaster nigra*] parasite of the sugar-cane froghopper (*Tomaspis saccharina*), forwarded for colonising purposes. Eggs are sent out in small tins with holes punched in the lids. One or two grass roots are placed in the tins. Usually from two to five froghopper nymphs in froth are on the roots, and in this froth are the eggs; about 30 to 100 eggs are sent in each tin. The roots should not be removed from the tin until they are placed on sugar-cane roots, where froghopper nymphs are most numerous. Adult Syrphids are sent in glass tubes. Eggs should be dealt with as soon after receipt as possible, as they hatch quickly.

Insect Notes; the Difficulties of Plant Quarantine.—*Agric. News, Barbados*, xiv, no. 341, 22nd May 1915, pp. 170–171.

Attempts to prevent the introduction of new insect pests are made upon two main lines; one deals especially with pests of staple crops, having only general regard to insects attacking minor crops and ornamental plants, while the other has for its object the interception and destruction of every pest of all crops and plants. In California, where quarantine regulations are perhaps more comprehensive than elsewhere, inspection does not extend to material forwarded by post [see this *Review*, Ser. A, iii, p. 120]. In the Lesser Antilles, attempts are made to prevent the entrance of pests of the principal crops. Thus in all islands where cotton is grown, the importation of cotton seed from localities in which the cotton boll weevil [*Anthonomus grandis*] occurs is prohibited. This precaution would also be useful in the case of the pink boll worm [*Gelechia gossypiella*]. Cotton seed imported for extraction of oil is fumigated for protection against cotton stainers. Scale-insects, froghoppers [*Tomaspis*] and giant moth borers [*Castnia licus*] of sugar-cane have been made the subject of special legislation. The existing methods of fumigation are imperfect. Mealy-bugs, soil-inhabiting larvae, etc., are protected to a considerable extent by the soil surrounding the roots of the host plants. Sulphur dioxide can only penetrate a distance of 3 inches into cotton seed, but it is possible that fumigation in a partial vacuum may increase the efficiency of this treatment. Inspection of baggage of every description by trained entomologists is desirable, but this involves an expense which is beyond the means of small communities.

Insect Notes.—*Agric. News, Barbados*, xiv, no. 342, 5th June 1915, pp. 186–187.

The insect enemies of maize in the West Indies are *Laphygma frugiperda* (corn ear worm) and *Chloridea* (*Heliothis*) *obsoleta* (cotton boll worm). It is probable that with the extension of maize cultivation, the above-mentioned pests will rapidly increase, unless suitable methods of control are used [see this *Review*, Ser. A, iii, p. 449]. Efforts should be made to prevent the introduction into the West Indies of *Gelechia gossypiella*, Saunders (pink boll worm). This has become a serious pest in Hawaii. *Mocis repanda*, F. (Guinea grass moth) has been

scarce in Barbados until the present season, when it appeared in large numbers in several localities. The larva, beside feeding on Guinea grass, attacks also Para grass. The eggs are deposited in masses on the under side of the leaf, close to the midrib. The larva hatches in about five days, and feeds on the leaf. Pupation occurs in about 20 days in a cocoon partly enclosed by the leaf. The adult emerges after five days. The insect appears to be well controlled by natural enemies. If a serious outbreak occurs, the grass crop should be cut when most of the cocoons are formed, in order to prevent further oviposition. Any larvae of the second brood which may survive, can be destroyed by an application of Paris green. Blackbirds, turkeys, guineafowls, and domestic fowls are useful enemies of this insect.

Foster (S. W.). **Combination Spraying Experiment for the Control of Mildew and Leaf-Hoppers on Grape Vines.**—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, nos. 5 and 6, May and June 1915, pp. 250–253.

Experiments for the control of mildew and leaf-hoppers were conducted in Fresno county, Cal. Spraying was performed soon after flowering, at a time when nymphs were abundant, but when no noticeable injury had been caused by mildew. As a result it was found that a spray consisting of 24 lb. atomic sulphur paste, 1 pt. Black Leaf 40, 2 lb. fish glue, and 200 U.S. gals. water was most satisfactory. Only one application was necessary. The bunches of grapes were noticeable at harvest time for the uniformity in the size of the fruit and the absence of mildew. The cost of treatment was less than £1 per acre. A combination of whale oil soap and nicotine (12 to 16 lb. soap, 1 pt. Black Leaf 40, 200 U.S. gals. water) gave satisfactory results in controlling vine-hoppers, all nymphs present at the time of application being killed.

Brock (A. A.). **The Misuse of the Distillate Oil Mechanical Mixture.**—*Mthly. Bull .State Commiss. Hortic., Sacramento, Cal.* iv, nos. 5 and 6, May and June 1915, p. 274.

A distillate oil mixture used for spraying apricots in Ventura county was made up according to the following formula: 200 U.S. gals. water, 7 lb. caustic soda (95 per cent.), 12 U.S. gals. distillate (28° Bé.). Examination after spraying showed that in some cases one side of a tree had been left almost untouched; in others, where newly-planted trees had been sprayed, as much material had been used as for older trees. Several young trees were killed entirely and the branches of older trees were frequently destroyed. Where the spray material had been used on citrus trees and palms, much injury resulted. The destruction of the trees could be attributed to want of frequent agitation of the mixture and the consequent application of almost pure distillate. The material should be agitated for from 5 to 10 minutes before beginning to spray. For non-deciduous trees, the strength of the spray should be reduced.

Hartung (W. J.) & Severin (H. H. P.). Natural Enemies of the Sugar-Beet Leaf-Hoppers in California.—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, nos. 5 and 6, May and June 1915, pp. 277–279, 1 table.

In order to secure data on the percentage of parasitised examples of *Eutettix tenella*, Baker (sugar-beet leaf-hopper), specimens were collected by sweeping beet leaves with an insect net. On 2nd September 1913, 500 insects were collected from leaves showing a severe condition of "curly-top." During the three weeks following, 12 puparia of a Dipterous parasite and 12 dead leaf-hoppers were found in the breeding jars. Four Jassids showed the presence of a larval sac of a Dryinid beneath one or other wing; each hopper thus attacked died after the emergence of the larva. The pupal period of the Diptera lasted for 22 days and that of the Dryinidae 40 days. The Dipterous parasites were identified as *Pipunculus industrius* and *P. vagabundus* and the Dryinid as *Gonatopus contortulus*. From the data obtained during 1914, 33·6 per cent. of the leaf-hoppers were parasitised. A fungus disease was found to attack the hoppers in one locality.

Vosler (E. J.). Calendar of Insect Pests.—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, nos. 5 and 6, May and June 1915, pp. 280–284, 2 figs.

The leaves of deciduous fruit trees are often seriously damaged by the brown mite [*Bryobia pratensis*] and the two-spotted mite. The eggs of red spiders [*Tetranychus* sp.], deposited on the under side of the leaves, can be destroyed by dusting or spraying with sulphur. Lime-sulphur, diluted to 2 per cent. or 2½ per cent. strength and applied at a pressure of from 150 to 200 lb., will effectively control the citrus red spider [*Tetranychus mytilaspidis*]. *Diabrotica soror* can be killed by spraying with lead arsenate, 4 lb. to 50 U.S. gals. water. The distribution of the orange thrips [*Scirtothrips citri*] in California is limited to the San Joaquin Valley and the southern orange belt; four applications of lime-sulphur or nicotine spray may be necessary to control this insect.

Insect Notes.—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, nos. 5 and 6, May and June 1915, 285–286.

Hypera variabilis (*Phytonomus posticus*) (alfalfa weevil) has, up to the present time, failed to become established in California. *Aphis pomi* (green apple aphis) was reported from Sonoma county. *Polycaon confertus* (olive-twig borer) was present in various parts of north California. Specimens of the first generation of *Hippodamia convergens* were abundant in Sacramento county on 22nd April. *Typhlocyba comes* (grape leaf-hopper) has been reported in Ventura county. Several thousand specimens of the new Encyrtid parasites of the citrus mealy bug from Sicily, hitherto known as *Leptomastix*, have been distributed. A small Coccinellid in all stages was found to be destroying *Aulacaspis rosae* (rose scale) in Sacramento. A Douglas spruce in Sacramento county has been reported as heavily infested

with *Chermes cooleyi*, Gillette. The pea crop in Alameda county has been injured by an Aphid, *Macrosiphum destructor*. *Xyleborus xylographus*, Say (shot-hole borer), has been observed in San Bernardino and Riverside counties; adults and larvae were taken from dead and living wood of apple and apricot. In one case, the apricot trees had previously been injured by spraying with distillate oil mechanical mixture for black scale.

MASKEW (F.). **Quarantine Division; Report for the Month of March 1915.**—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, nos. 5 and 6, May and June 1915, pp. 287–289.

The following pests have been intercepted :—From Central America : *Aspidiotus cyanophylli* on bananas. From China : *Phomopsis citri* on pomelos ; *Cylas formicarius* in sweet potatoes. From Cuba. *Lepidosaphes beckii*, *Parlatoria pergandii* and a fungus on citrus trees ; *Howardia biclavis* and *Aspidiotus lataniae* on jasmine, gardenia and climbing vine ; *A. lataniae* on coconut palm ; *Chrysomphalus aonidum* on palm ; *Pseudococcus citri* on crotons and various plants. From Honolulu : *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples ; *Hemichionaspis minor* and *Chrysomphalus aonidum* on green coconuts ; *Coccus longulus* on betel leaves ; *Fiorinia fioriniae* on flowering plants ; *Ceroplastes rubens* on leis. From Idaho : *Aulacaspis pentagona* on *Pueraria thunbergiana* ; *Chionaspis citri* on oranges ; *Cylas formicarius* in sweet potatoes. From Japan : *Chionaspis wistariae* and Mantid eggs on wistaria ; *Hemichionaspis aspidistrae* on ribbon grass ; *Thyridopteryx ephemeraeformis* and Mantid eggs on persimmons ; *Parlatoria theae* on maples ; *Pseudaonidia paeoniae* on holly. From Kansas : *Aulacaspis rosae* on berry plants. From Manila : *Aspidiotus lataniae* on palm trees. From Mexico : *Lepidosaphes gloveri* and *Lepidosaphes beckii* on limes. From Missouri : *Aphis persicae niger* on peach. From Nevada : *Heterodera radicicola* in potatoes. From Ohio : *Aspidiotus perniciosus* on peach ; *Lepidosaphes beckii* on Ponderosa lemon ; *Lepidosaphes ulmi* on horse chestnut. From Pennsylvania : *Chrysomphalus aurantii* on pandanus. *Cerataphis lataniae* on palm ; *Chrysomphalus aonidum* on Aralia and Maranta ; *Coccus hesperidum* on Maranta ; *Pseudococcus pseudonipae* on palms. From Tahiti : *Chrysomphalus aurantii* var. *citrinus* on oranges and *Lepidosaphes beckii* on limes.

SURFACE (H. A.). **June Bugs destroying Grapes.**—*Zool. Press. Bull., Pennsylvania Dept. Agric., Harrisburg*, no. 318, 31st May 1915.

June bugs (*Allorrhina nitida*) attacking grapes can be controlled by spraying with lead arsenate, at the rate of 1 oz. to 1 U.S. gal. water. Application should be made just after the stamens of the flowers fall, and should be repeated two weeks later. Hickory, oak, chestnut, etc., growing in the vicinity should be sprayed with lead arsenate, 2 lb. in 50 U.S. gals. water. Young fruit may be protected by means of a paper bag fastened round the cluster just after the flowering period is ended.

SURFACE (H. A.). **The Buffalo Carpet Beetle.**—*Zool. Press Bull., Pennsylvania Dept. Agric., Harrisburg,* no. 318, 31st May 1915.

Carpets attacked by the buffalo carpet beetle [*Anthrenus scrophulariae*] should be exposed to air and sunlight for some hours, and the floors washed with 3 per cent. solution of creolin. After replacing the carpets, the edges should be sprayed with a dilute solution of corrosive sublimate in alcohol or water [see this *Review*, Ser. A, iii, p. 184].

WASHBURN (F. L.). **Personal Experience with the Clothes Moth.**—*Minnesota Insect Life, St. Anthony Park, Minn.*, iii, no. 3, 1st. June 1915, p. 5.

Fur and woollen materials can be successfully preserved from attacks of moths by placing in a galvanised iron box with a well-fitting lid, together with a shallow dish containing a small quantity of carbon bisulphide. The box should not be opened for at least two or three days after treatment. The carbon bisulphide should be renewed about three weeks later and again at longer intervals if necessary.

MCATEE (W. L.). **Bird Enemies of Forest Insects.**—*American Forestry, Washington, D.C.*, xxi, no. 6, June 1915, pp. 681–691, 12 figs.

Birds are the most important of the natural enemies of forest insects and more than 45 species are known to feed on bark beetles. The larvae of the round-headed and flat-headed wood-borers are destroyed by woodpeckers. The leopard moth, a pest of shade trees, is held in check by several native birds. The red-shafted flicker, pileated woodpecker and the nighthawk are specially destructive to carpenter-ants. The absence of forest tent-caterpillars in some localities has been correlated with the abundance of bird enemies. In California, the brewer blackbird has on several occasions freed the orchards from canker-worm. The English sparrow was introduced into America for the purpose of suppressing the linden moth and, in England, the attraction of birds has been adopted as a definite method of combating the larch sawfly.

Advice for the Month of June.—*American Forestry, Washington, D.C.*, xxi, no. 6, June 1915, pp. 717–718.

The nests of forest tent caterpillars [*Malacosoma disstria*] on wild cherry, mulberry, willow, etc., should be destroyed by applying a burning rag or torch to the web or by squirting a little kerosene into it. Leaf-eating insects should be sprayed with lead arsenate, at the rate of 1 lb. to 10 U.S. gals. water. Hickory trees infested with the hickory bark borer [*Scolytus quadrispinosus*] should be removed and destroyed before the emergence of the adults in June. The presence of the insect can be detected by small holes in the bark and the fine sawdust ejected from these. In the vicinity of New York City, including all Long Island, parts of New Jersey and Westchester county, hickory trees are badly infested with this pest.

Farrand (A. H.). **Killing timber by ring barking and poisoning, as practised in New South Wales.**—*Queensland Agric. Jl., Brisbane*, May 1915, pp. 191, 192 and 225.

Suggestions have been made that the attack of insect pests may possibly be prevented by the injection of poisonous matter into the sap stream of the tree [see this *Review*, Ser. A, iii, pp. 73 and 394]. Poisoning with arsenic has been extensively practised in Queensland in recent years for the purpose of clearing land for agricultural use. The tree is "frill ringed" near the bottom and the arsenical solution poured into the space between the lifted bark and the wood, the poison rises with the sap and the tree is killed above the ringing, the bole and roots survive and yield a heavy crop of suckers. It is stated that if the arsenic be applied on one side only the effect is limited to the part of the tree above the point of application and to the branches arising from it. The arsenical mixture used consists of 2 lb. white arsenic and 1 lb. caustic soda in 2 gallons of water. This is a very strong solution, but the use of arsenic for poisoning trees sufficiently to prevent insect attack without damage to the tree or the poisoning of its fruit does not appear to be very feasible.

Jarvis (E.). **Coping with the Cane Grub.**—*Queensland Agric. Jl., Brisbane*, May 1915, pp. 220–222.

The ideal methods of combating the cane beetle are those which succeed in destroying the female before oviposition, at the same time, the greater length of the larval period enables control measures to be practised for at least six months while the pest is underground and is subjected to certain forms of climatic and natural control which do not affect the adult. The following methods of checking the larva are given, the figures indicating the order of efficiency and practicability:—(*a*) Direct and remedial methods; (1) incorporating with the soil by cultural operations some enduring substance which will prove fatal to the larvae and at the same time possess manurial properties; (2) the application to cane furrows of an inexpensive deterrent sufficiently obnoxious and durable to protect a limited area containing main roots from invasion during most of the growing season; (4) fumigation of the soil with a gas fatal to the larvae, but having, if possible, a stimulating effect on vegetation; (7) applying an insecticidal solution to the main roots. (*b*) Preventive methods; (3) collecting grubs by hand; this method is extensively practised and is of great importance, though theoretically no. (1)—which is still in the experimental stage—must ultimately prove superior to it; (5) exposing grubs to the sun and attacks of natural enemies; (8) encouraging a vigorous root development and conditions favourable to conservation of moisture by manuring and thorough cultivation; (10) clean cultivation during the growing season. (*c*, Natural control; (6) infecting the soil artificially with "Green Muscardine" fungus or other parasitic disease; (9) promoting the protection of indigenous grub-eating mammals and birds, together with the preservation, when feasible, of insect enemies of cane beetles; (11) the introduction of parasitic and predaceous insects; (12) the destruction where practicable of a Bombyliid hyperparasite which materially checks the increase of parasitic "digger wasps."

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THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

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MAISONNEUVE (P.). **Enquête sur le piégeage de la Cochylis en Anjou en 1914.** [An enquiry into the trapping of *Clysia ambiguella* in Anjou in 1914.]—*Rev. Vitic., Paris*, xlii, nos. 1091-1092, 27th May & 3rd June 1915, pp. 441-446 & 464-465.

The control of *Clysia ambiguella* by means of bait-traps is advantageous, as only unskilled workers are required. In 1914, trapping was extensively practised in Maine-et-Loire, one manufacturer of trap-glasses delivering 300,000 glasses in that department alone. The author's experiments covered 500 acres, distributed throughout the region. Nothing is gained by having a glass with an opening of large diameter, one of 2½ inches proving just as effective as one of 5 inches. The provision of a cover placed over the glass does not appear to be justified, in contrast to Feytaud's experience. The difference is possibly due to meteorological conditions. Reports were received on 68,000 traps, which collected about 307,000 moths in the spring trapping period. The number of moths taken varied from 26 to 2,800 per acre, the average being from 440 to 600. A number of causes influence these results, and in the case where only 26 moths per acre were taken, one reason was that the replenishing of the bait-liquid only took place every fifteen days. The average number of moths per trap was 4·75, which is satisfactory, as each female of the spring generation may produce 100 moths of the summer one. The vine harvest was exceptionally good in Maine-et-Loire in 1914 and the traps must undoubtedly have been a factor in producing this result. In many of the reports made, it is stated that the vineyards where this control was practised were less infested than others. It should however be remembered that another factor was a sudden rise of temperature from the 10th to 15th August, which caused a great mortality among the caterpillars. Trapping continued through the month of May. On an average, a total of from 140 to 210 pints of bait-liquid was used per acre; vigorous fermentation is very necessary. Captures do not appear to be influenced by the composition of the soil, nor does the aspect of the vineyard have any apparent influence. *C. ambiguella* is therefore apparently indifferent to these factors. The variety of vine exercises some slight influence on the moth, which seems to prefer the following varieties in the order given: Gamay, Pinot de la Loire, Groslot, Cabernet, Othello. During 1914, some vinegrowers in Maine-et-Loire captured from 100 to 2,800 moths per acre, whereas in the author's two vineyards the figures were 134 and 59. Whilst the author was capturing 134 moths per acre, a neighbouring vinegrower took 640 per acre. This result must be due to the very careful trapping practised by the author in 1913, when his catches were 1,200 and 2,400 per acre. It therefore seems that trapping need not necessarily be practised throughout a given district in order to be of use. The results produced by trapping during a given year seem to last through the succeeding one and this should encourage growers to persevere with this method without a break, especially as they will have on hand their stock of glasses, etc., and need incur no further expense on that score. As in previous years, the number of females was several times as large as that of the males. During the early days of the flight period, the number of eggs found in various females ranged from 120 to 170. The incubation period was observed

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in one case and proved to be 9½ days. Some bait-traps appear to be specially attractive to the moths and investigation of the reason would be amply repaid. In 1914, insecticide treatment was carefully carried out, but lack of labour permitted only one application, whereas two are necessary for practical results.

SEMICHON (L.). **L'économie dans les soufrages et les sulfatages.** [Economy in spraying with sulphur and copper sulphate.]—*Rev. Vitic., Paris,* xlii, no. 1093, 10th June 1915, pp. 483–485.

To spray both efficiently and economically, hot neutral copper sprays should be applied every twenty or twenty-five days. In the intervals, the vines should be dusted with sulphur mixed with sulphated talc or with sulphur and copper hydrate. An excellent mixture consists of sulphur and cupric talc in equal parts. Talc usually contains 10 per cent. of carbonate of lime, and if 10 per cent. of finely ground copper sulphate is added, the acidity of the copper sulphate is neutralised by the lime. This prevents scorching and the cupric precipitate of hydrate and carbonate is far less soluble than the sulphate and protects for a longer time. These facts should be borne in mind when selecting a cupric powder. The method of treatment given above will effect a saving in sulphur and copper sulphate, whilst acting with great efficiency against mildew, oidium and injurious insects, especially *Clysia ambiguella* and *Polychrosis botrana*. Four sprayings and four dustings will require 83 lb. of copper sulphate and 114 lb. of sulphur per acre.

CHAUVIGNÉ (A.). **Les sulfatages chauds contre la Cochylis.** [The control of *Clysia ambiguella* with hot cupric spray solutions.]—*Rev. Vitic., Paris,* xlii, no. 1094, 17th June 1915, pp. 503–505.

It is stated that although M. Semichon's methods and formulae for the application of hot spray solutions [see this *Review*, Ser. A, ii, p. 685] were adhered to in a series of trials, the results invariably proved inefficacious. It would appear that a temperature of at least 131° F. is necessary and this is apparently unattainable with the methods in question, at least in a practical manner for areas of medium or large size. The egg and larva of *Clysia ambiguella* only seem to be affected by dry heat, so that water, even if at a temperature of 131° F., may not be harmful to the insects.

GASTINE (G.) & VERMOREL (V.). **Destruction des parasites des plantes par la chaleur humide.** [The destruction of plant pests by damp heat.]—*Rev. Vitic., Paris,* xlii, no. 1095, 24th June 1915, pp. 521–526.

The authors refer to their experiments in control by means of steam; these were carried out in 1902 and published at that time. It was first ascertained that damp heat would kill most injurious insects in a much shorter time than was required to damage the tissues of the most sensitive plants, such as the young leaves of the vine. Diagrams are given to show this. In practice, a bell was placed over the vine-stock and steam from a small boiler was conducted to it and caused to issue against its inner surface. In condensing, the steam warmed the

air within the bell and produced a damp heat. The bell was provided with a flat bottom which fitted round the trunk of the vine like a collar and along this bottom plate the steam entered. A thermometer, the bulb of which was within the cover, indicated the degree of heat and guarded against overheating. On the limit being reached, the supply of steam was cut off, the cover being left untouched until the proper time had elapsed. This period lasted from 3 to 4 minutes; the temperature was 120°–122° F. A vineyard strongly infested with *Sparganothis pilleriana* was chosen and 8 cloches were used, 4 being in action whilst the other 4 were being placed or removed. A squad of 3 workmen permitted the work to be quickly done. Radical results were obtained against *S. pilleriana* and *Clysia ambiguella*. Each time a cloche was removed a very great number of dead insects were seen, the quantity being quite unexpected from the appearance of the stock. Photographic records were taken and are kept at the Station Viticole de Villefranche. Various gases had been tried previous to the steam trials and all had proved defective, inasmuch as they injured the plants more than the pests. When the steam entered the chamber the larvae immediately began to move about and soon fell on the bottom plate, which was heated to 212° F. Dry heat would not be so effective, as the larvae could cause evaporation by breathing quickly and thus contend against the increase of temperature. The difference between the degree of heat recommended here and the considerably higher one advised by M. Semichon is more apparent than real, as in the latter case, contact with the air and also evaporation must certainly cause a considerable loss of heat. M. Semichon himself has advised care in adjusting the time to the temperature, a longer time being only permissible with a lower temperature. The use of cloches has this great advantage: when seeking to escape, the larvae necessarily reach the bottom plate, the great heat of which kills them instantly. The employment of hot water itself was also advised by Vermorel in 1912 [see this *Review*, Ser. A, ii, p. 375].

SEMICHON (L.). **Traitement des vignes à l'eau chaude et aux bouillies chaudes.** [The treatment of vines with hot water and hot spray solutions.]—*Rev. Vitic., Paris*, xliii, no. 1096, 1st July 1915, pp. 9–12.

Referring to MM. Gastine and Vermorel's communication on the use of steam in controlling insect pests [see above], the author considers that steam is preferable to hot water against the larvae, whether they be protected by their cocoons or not, and also against Aphids and other insects which are directly vulnerable. For the destruction of eggs, hot water is more efficient; it will also be useful against quite newly hatched larvae and in any case its use is exceedingly simple, no special apparatus being necessary as with steam. According to Chauvigné [see above], the minimum useful temperature of 131° F. is not obtainable in practice where medium or large size areas are concerned, but it must be remembered that the minute drops of hot water only require to scald the insects superficially and it is not necessary that the whole of the insect's body should be raised to the same high temperature in order to cause death. Splashes of hot water falling on the hand provide a parallel case; the skin is scalded, but

the temperature of the entire hand is not raised. Hot water acts instantaneously and for a very brief period of time; the action of hot, damp air is much slower.

Ravaz (L.). **Encore l'eau chaude.** [Hot water again.]—*Progrès Agric. Vitic., Montpellier*, lxiii (32nd year), no. 24, 13th June 1915, pp. 555–558.

M. Faës, Director of the Vine Research Station at Lausanne, has communicated detailed information regarding experiments with hot solutions undertaken in 1903. At temperatures between 113° and 122° F., their insecticidal power was certainly enhanced. Hot water alone was insufficient when under 122° F. Vines did not appear to be affected by solutions between 104° and 122° F.

The author is doubtful whether hot solutions may not decompose or rapidly deposit the cupric salts which are the active ingredient in the sprays. Not only is the precipitate more rapidly thrown down in a hot solution, but it occupies a smaller volume, owing to the fact that heat agglomerates a precipitate. A dense precipitate is less easily acted on by dissolving agents, such as atmospheric carbonic acid, than a flocculent one. In making up spray mixtures, vine-growers have always aimed at obtaining a well-diffused precipitate. A further disadvantage of the hot method is that heat transforms certain bodies sensitive to the dissolving action of the carbonic acid contained in water into almost inactive compounds; thus, the blue hydrocarbonate of copper, found in nearly all spray solutions, is rapidly changed by heat into a malachite green, dense hydrocarbonate, which is but slightly dissolved by carbonic acid. Hot water does not therefore enhance the quality of a cupric spray. In any case, the whole matter is far from being decided.

Scott (H.). **Swarm of *Barypithes* (*Exomias*) *pellucidus*, Boh., in Cambridgeshire, and notes on its food-plants.**—*Entomologists' Mthly. Mag., London*, no. 614, July 1915, pp. 218–219.

A swarm of these weevils occurred in May 1915, at Fordham; kale, kohl-rabi, peony-flowered poppy, *Nemophila insignis*, *Collinsia bicolor* and *Acer marginata aurea* were attacked. *Gypsophila elegans*, potatoes, peas and spruce escaped injury. The weevils generally feed on the lower surfaces of the leaves. Many seedlings were eaten off just above the ground. The infested plants were treated with a mixture of lime and soot, which proved effective.

Hewitt (C. G.). **The Outbreak of the Western Army Cutworm in Southern Alberta.**—*Agric. Gaz. Canada, Ottawa*, ii, no. 6, June 1915, p. 521.

During 1914, the moths of the western army cutworm, *Euxoa* (*Chorizagrotis*) *agrestis*, were extremely abundant in Southern Alberta, and a serious outbreak was expected and occurred in the spring of 1915. The value of early trenching was demonstrated. Deep furrows were ploughed round infested fields, after which a log, with a

man standing on it, was drawn through the trench to make a dust furrow. On beginning their spring migration, the caterpillars wandered into the trenches, where they were killed with a poisoned bait made by adding 1 lb. of Paris green to 50 lb. of shorts and then pouring in $1\frac{1}{2}$ gals. of molasses dissolved in 1 gal. of water. Ten pounds of the shorts is sufficient to treat 70 rods of furrow. In one experiment 537 dead larvae were found in one foot of trench. Stinkweed and lucerne hay poisoned with Paris green and placed along in the trenches was also found of value. Mr. Strickland's discovery of this use for stinkweed is of no little significance in view of the prevalence of this weed on neglected lands and its increase. The appearance of this pest is probably influenced by the occurrence of this weed, upon which the female moth deposits her eggs. *E. agrestis* is distinct from the cutworm (*Porosagrotis orthogonia*), an outbreak of which occurred two or three years previously [see this *Review*, Ser. A, ii, p. 487].

DUPORTE (E. M.). **Report on some Phases of Entomological Investigation.**—*Agric. Gaz. of Canada, Ottawa*, ii, no. 6, June 1915, pp. 569–572, 2 figs.

Four parasites of the bud-moth (*Eucosma ocellana*), have been found, the most important being the egg parasite, *Trichogramma* (*Pentarthron*) *minutum*. The larval and pupal stages of this Chalcid are passed in the egg of the host. From *Phyllotreta sinuata*, which was recorded during 1913 and 1914 on the leaves of cress and radish, a Hymenopterous parasite, *Pleurotropis* sp., was reared. *Bruchophagus funebris*, the clover seed Chalcid, was observed in Canada for the first time in 1913. The egg and larval stages are passed in the clover seed. There are at least two broods annually; hibernation takes place in the seed on the ground or in stored seed. Control measures consist of the early cutting of the first crop, the fumigation of new seed before planting, and the drilling of seed as deeply as possible to prevent the emerging Chalcids from reaching the surface. *Chortophila* (*Phorbia*) *fusciceps* has been found feeding on the roots of turnips; the same remedies may be applied as against *C. brassicae*.

MCCOLLOCH (J. W.) & YUASA (H.). **A new Parasite of the Chinch Bug Egg (Hym.).**—*Entom. News, Philadelphia*, xxvi, no. 4, April 1915, pp. 147–149, 3 figs.

During 1914, an investigation of the life-history of *Eumicrosoma benefica*, Gahan (chinch bug egg-parasite) was carried out in Kansas. To determine the percentage of parasitism, eggs were collected during the summer and separated into lots of from 10 to 50. These were placed in small vials and examined daily. On 4th August, a greenish parasite emerged from eggs collected from crab grass on 27th July, the emergence hole differing from that of the host or of *E. benefica*. A second individual emerged on 10th August from eggs collected on 1st August. Collections were made of all kinds of eggs found in the habitat of the chinch bug and its parasites in order to determine whether *E. benefica* had any other host. Large numbers of eggs believed to have been those of a leaf-hopper, were found to be parasitised by the same species, which was identified as *Abella subflava*.

Girault. This species is widely distributed in the United States and Australia, where it is parasitic on the eggs of a Jassid infesting wheat straw. The length of the adult life ranges from 7 to 14 days when fed on sweetened water. This parasite probably plays an insignificant part in the control of the chinch bug and the fact that only two parasites have been reared from a large number of eggs, indicates that parasitism is accidental rather than natural [see also this *Review*, Ser. A, ii, pp. 383 and 384].

WEISS (H. B.). **Preliminary List of New Jersey Acarina.**—*Entom. News, Philadelphia*, xxvi, no. 4, April 1915, pp. 149–152.

This list includes the following species:—*Bryobia praetiosa*, Koch, (*pratensis*, Garman), clover mite, on leaves of clover and fruit trees; *Tetranychus bicolor*, Bks., on apple, silver maple (*Acer saccharinum*, L.) and other plants; *T. bimaculatus*, Harvey, the common red spider of greenhouses, which attacks roses, carnations, palms, violets, etc., under glass, and in some seasons is a pest on outdoor plants; *T. pilosus* on fruit trees; *Microtrombidium locustarum*, Walsh, on eggs, nymphs and adults of grasshoppers; *Macrocheles marginatus*, Herm., on the beetle *Allorrhina nitida*; *Tarsonemus pallidus*, Bks., on chrysanthemums under glass; *T. waitei*, Bks., (peach-bud mite), attacking the terminal buds or shoots of peaches, usually on nursery trees; *Pediculoides ventricosus*, Newp., attacking the larvae of the grain moth (*Sitotroga cerealella*) and *Bruchus quadrimaculatus*; *Pediculopsis graminum*, Reuter, found in connection with bud-rot of carnations in greenhouses, which, according to Stewart and Hodgkiss, is caused by *Sporotrichum poae*; this mite appears to introduce the spores of the disease to the flower-buds. Treatment consists in promptly picking and burning all infested buds. *Tyroglyphus farinae*, De Geer, infests flour and stored foods; *T. lintneri*, Osb. (mushroom mite), sometimes destructive to mushrooms; *Rhizoglyphus phylloxerae*, Riley, in asparagus shoots; and *Eriophyes pyri*, Pgst. (pear-leaf blister-mite), on pears and sometimes apples.

HOOD (J. D.). **On some American Aeolothripidae (Thysanoptera).**—*Entom. News, Philadelphia*, xxvi, no. 4, April 1915, pp. 162–166, 2 figs.

The paper gives an account of the distribution in America of two species of *Franklinothrips*, and one species of *Aeolothrips*. *F. vespiformis*, Crawford, has been taken in Nicaragua, Florida, Texas, Canal Zone (Panama) and Moro Island (Panama). *F. tenuiformis*, sp. n., was found at Moro Island. *A. albicinctus*, Haliday, has been recorded from Canastota, N.Y., on leaves of maize in August 1912; from Chester, N.Y., on onion on 14th August 1912; and from Elmira, N.Y., on onion on 1st July 1912. This species also occurs in England, Finland, Sweden, Austria, Italy, Portugal, and Sardinia.

BAKER (A. C.) & TURNER (W. F.). **The Brown Grape Aphid.**—*Science, Philadelphia*, xli, no. 1066, 4th June 1915, p. 834.

The life-history of *Macrosiphum viticola* at Vienna, Va., is as follows:—

The eggs are laid late in October or in November in the axils of the

leaves of *Viburnum prunifolium*. In spring they hatch before the leaves open and the young feed on the bursting flower buds. Late in April or early in May, the second generation matures and this nearly all becomes alate. Such forms migrate to the grape and produce the third generation. Apterous and alate forms occur throughout the summer. Autumn migrants return to *Viburnum* in October to oviposit.

McAtee (W. L.). **Psyllidae wintering on Conifers about Washington, D.C.**—*Science, Philadelphia*, xli, no. 1069, 25th June 1915, p. 910.

The following species of Psyllids are known to winter on *Pinus virginiana* in the vicinity of Washington: *Livia maculipennis*, *L. vernalis*, *Aphalara calthae*, *Trioza salicis*, and *T. tripunctata*. Coniferous trees are only used as alternate food-plants and winter shelters. Records show that the habit of resorting to conifers is not restricted to the cold season; *L. vernalis* has been taken on pine in June and July, and *A. calthae* in April. These Psyllids occur also on *Pinus taeda* and *Juniperus virginiana*. *Pachypsylla celtidis-mamma* has been found from October to February on juniper and hemlock.

Severin (H. H. P.) & Severin (H. C.). **Kerosene Traps as a Means of checking up the Effectiveness of a Poisoned Bait Spray to control the Mediterranean Fruit-Fly (*Ceratitis capitata*, Wied.) with a Record of Beneficial Insects captured in the Kerosene.**—*Jl. Econ. Entom., Concord*, viii, no. 3, June 1915, pp. 329–338, 1 fig. 4 tables.

In a series of experiments on the use of petroleum and vegetable or animal oils to trap Mediterranean fruit-flies, it was found that kerosene (about 120° Bé.) gave the best results, with the possible exception of distillate (about 48° Bé.). Adult fruit-flies require a feeding period of from 10 to 12 days before egg-laying begins; during this time they subsist on the waxy coating of fruit, the juices of injured fruit and to some extent on the flowers of a chrysanthemum imported from Japan, and in captivity, on diluted molasses. Feeding continues during the reproductive period. The poisoned bait used in the experiments was prepared according to the following formula: brown sugar, 2½ lb.; lead arsenate, 5 oz.; water, 4 U.S. gals. To determine the effectiveness of the spray as a means of controlling the fruit-fly under Hawaiian conditions, the following plan was adopted. For a period of five weeks, 10 kerosene traps were wired to the branches of citrus trees in an orchard containing about 400 orange, lemon, grape-fruit, banana, etc. No spray was applied to any of the trees or vegetation during this time; data were kept regarding the number of fruit-flies and beneficial insects found dead in the oil traps. During the next five weeks, the poisoned bait was sprayed once a week on all the fruit-bearing trees and a record kept of all insects caught in the traps. An average of 1 female and 291 male flies was obtained daily during the period before spraying; there was no decrease in the numbers caught daily at the end of the period and at the end of the fifth week almost every ripe orange was injured. The spray was applied under unfavourable weather conditions and the experiments were conducted

in an orchard adjacent to a neglected orchard which was badly infested. The average capture was 5 males per day and 1 female every 4 days; 93 specimens were caught during the first 6 days, and 89 during the following 29 days. For a third period of 5 weeks no spray was applied, but the kerosene traps were retained; the average capture was 19 males per day and 1 female every 30 days. This period showed an increase in the numbers of the fly and the amount of fruit injured. Trapping with kerosene was continued in connection with other experiments, and 15 weeks after spraying was discontinued, 642 fruit-flies were captured in three days in the 10 traps. The increase in the number of fruit-flies after spraying was discontinued, may be attributed (1) to the fact that horticultural sanitation was not rigidly practised; (2) to the proximity of the orchard under treatment to a neglected one and (3) to the breeding of the fly in wild fruits in mountainous districts, whence they were carried by the wind to the experimental orchard. Similar experiments carried out in a residential section of Honolulu showed that spraying resulted in a marked, but temporary, reduction in the number of flies caught by the kerosene trap. Reduction was greatest about five days after spraying, after which time the spray became ineffective, and flies coming in from outside sources raised the number again. The leaves of grapefruit and peach were found to have been injured after the 5th spray; later, the leaves began to fall and, in the case of the peach, almost entire defoliation occurred. The spray was found to attract honey bees. Sprayed trees which were not in flower and were in the neighbourhood of unsprayed flowering trees were visited by the bees. The latter were observed feeding on the poisoned bait on the leaves of the sprayed trees and on the leaves of shrubs and grass beneath. In several cases the best honey-producing flowers were deserted in favour of the bait. A list of insects caught in the kerosene, other than the fruit-fly, is given. This includes winged Aphids, ants, mosquitos, bark lice, moths, cockroaches, Syrphid flies, *Adoretus umbrosus* (Japanese beetle), *Teleonomia lantanae* (lantana leaf-bug) and *Siphanta acuta* (torpedo bug). The beneficial insects captured were the following:—(1) Predaceous insects: COCCINELLIDAE: *Coccinella repanda*, Thunb.; *Cryptolaemus montrouzieri*, Muls.; *Orcus chalybeus*, Boisd.; *Platyomus lividigaster*, Muls.; *Rhizobius ventralis*, Muls.; *Novius* (*Vedalia*) *cardinalis*, Muls.; *Scymnus vividus*, Sharp; *Sticholotus punctatus*, Crotch; besides Coccinellid larvae, Staphylinids and lacewing larvae. (2) Parasites: Strepsiptera; *Elenchus melanias*, Perkins; TACHINIDAE: *Frontina archippivora*, Will.; *Chaetogaedia monticola*, Big.; Hymenoptera: *Tetrastichus hagenowii*, Ratz.; *Anastatus koebelei*, Ashm.; *Solindemia picticornis*, Cam.; *Encyrtus fuscus*, How.; *Chalcis obscurata*, Walk.; *Pimpla hawaiiensis*, Cam.; *Doryctes* (*Ischiogonus*) *palliatus*, Cam.; and *Cremastus hymeniae*, Vier.

RICHARDSON (C. H.). **A Contribution to the Life-History of the Corn-feeding Syrphus Fly** (*Mesogramma polita*, **Say.**)—*Jl. Econ. Entom., Concord*, viii, no. 3, June 1915, pp. 338–342, 1 plate.

An infestation of *Mesogramma polita*, Say, extending over a considerable area of sweet maize, occurred in Burlington county, N.J.,

during 1913. Previous records of this insect have been made from other parts of New Jersey and Delaware. The Syrphid was first observed during the last week in August, when adults and larvae were abundant. The numbers increased during September. On 11th October, the number had decreased perceptibly, but pupae were still present. Adults of both sexes seemed to feed exclusively on the pollen from the maize. Eggs were usually deposited in groups in the staminate flowers. Young larvae were found in these flowers, but seemed to migrate to the axils and wandered over the plant. No injurious effects upon the maize were noticed on this occasion. Pupation usually occurred along the modrib on the upper surface of the leaf. The most important enemy was a disease which appeared to be especially fatal to mature larvae. The larva of the Coccinellid, *Megilla fuscilabris*, attacked the pupae. No internal parasites were found by dissection of the pupae, although, in a few cases, eggs placed on leaves showed holes through which parasites had escaped. *M. polita* has caused injury to maize in Florida and Missouri. In Illinois, the green larva has been known to feed on the clover louse. Present information suggests that the species is sporadic in its attacks on maize.

SEVERIN (H. H. P.) & SEVERIN (H. C.). **Life-History, Natural Enemies and the Poisoned Bait Spray as a Method of Control of the Imported Onion Fly** (*Phorbia cepetorum*, **Meade**) **with Notes on other Onion Pests.**—*Jl. Econ. Entom., Concord,* viii, no. 3, June 1915, pp. 342–350.

Hylemyia antiqua, Mg. (*Phorbia cepetorum*, Meade), causes serious loss to onion-growers in some parts of Wisconsin. The female deposits its eggs between the stem and the ground, or in a crevice near the stem, at a depth of from one-eighth to one-fourth of an inch below the surface. Sometimes eggs are found within the axil of a leaf or on the leaf itself. Under field conditions the incubation period of eggs deposited by the first brood of flies in early June varies from three to four days. The larval period is completed in from two to three weeks in green onions, onion-sets and small seeded onions, but in seeded onions from the previous year, development of the larvae occupies from four to five weeks. The pupal period requires from 9 to 16 days during the latter part of June and early July. The fly was able to complete its life-history in from 29 to 35 days when placed below the surface of the soil in contact with radishes; when placed in fresh horse-manure, the life-cycle was completed in from 29 to 31 days. The majority of females showed mature eggs in the ovaries at the end of 16 days. The period of emergence of the second brood under field conditions extended from 28th June to 25th July, most of the flies issuing between 1st and 12th July. The most important natural enemy of *H. antiqua* in Wisconsin is a Staphylinid beetle, *Aleochara anthomyiae*, Sprague. *Oxybelus 4-notatus*, Say, and spiders have been observed attacking the fly. A single Hymenopterous parasite of the genus *Cothonaspis* was bred from the pupa. A contagious fungus disease killed large numbers of the fly. The rapid increase in the numbers of this pest in Wisconsin may be mainly attributed to lack of clean methods of cultivation. When onions are

so seriously infested that the crop is not worth harvesting, they are ploughed in, thus giving the pest an opportunity of completing its life-cycle. Crop rotation and autumn ploughing are not practised by many commercial onion-growers, though the latter method would expose many puparia to the sun and to natural enemies, such as birds and Carabid beetles. Experiments in the control of the adult during the preoviposition period showed that a poison consisting of 28 grains sodium arsenite, 1 U.S. gal. water and $\frac{1}{4}$ pt. molasses killed the flies within one day. In the field, the first application of the spray was made on the 10th July. Thorough spraying was found to be unnecessary, since the diluted molasses attracted the flies. Four applications were made to control the second brood, the bait being renewed once each week. The results obtained in an isolated field were encouraging, but the effectiveness of the spray against the first brood in non-isolated fields remains to be tested. Specimens of *Tritoxa flexa*, Wied. (black onion fly), were captured on 27th August. *Chaetopsis aenea*, Wied. (barred-winged onion fly), was bred from decaying and smut-infested onions. *Euxesta notata*, Wied., was reared from similar onions and from decaying onion leaves. The larvae were frequently found together with those of *H. antiqua*. The first noticeable injury caused by *Thrips tabaci*, Lind., was observed at the end of June, when the thrips were abundant between the two central leaves; in August the leaves had a whitened appearance produced by the attacks of the insect. *Agrotis* (*Noctua*) *c-nigrum*, L., and *Lycophotia margaritosa*, Haw. (*Peridroma saucia*, Hb.) caused slight injury in some districts. The former species was highly parasitised by *Apanteles* sp. The following insects were occasionally observed: *Ceramica* (*Mamestra*) *picta*, Harr. (zebra caterpillar), *Diacrisia virginica*, F. (yellow bear caterpillar), *Celerio* (*Deilephila*) *lineata*, F. (white-lined sphinx), *Lygus pratensis*, L. (tarnished plant-bug), and *Diabrotica* 12-*punctata*, Oliv.

MOZNETTE (G. F.). **Notes on the Brown Lace-Wing (*Hemerobius pacificus*, Bks.).**—*Jl. Econ. Entom.*, *Concord*, viii, no. 3, June 1915, pp. 350–354, 1 plate.

Hemerobius pacificus, Bks., is of considerable economic importance, in that it is predaceous in its larval stage on Acarina, APHIDIDAE and other soft-bodied insects. It destroys the oviparous females of *Aphis sorbi*, Kalt. (rosy apple aphis) and of *Myzus ribis*, L. (currant aphis). During July 1913, it was abundant in hop yards, feeding on the wingless females of the summer generation of *Phorodon humuli*, Schrank, and on *Tetranychus telarius*, L. (red spider). It has been recorded from Oregon, California, Washington, New Mexico, Arizona, and British Columbia. On 3rd November 1913, eggs and larvae were found among colonies of *A. sorbi* on apple trees; most of the eggs were deposited on the lower surface of the leaf next the midrib, lateral vein, or in the axil of the two. Eggs laid on marked leaves on 1st December 1913, hatched out under artificial conditions 9 days later. The larvae of *H. pacificus* developed more rapidly in warm than in cool weather; the average larval period was 14 days. The food supplied consisted of *A. sorbi*, Kalt., *Macrosiphum lycopersici*, Clark, and *Rhopalosiphum* (*Amphorophora*) *lactucae*, Kalt. Pupation usually took place in crevices of the bark, occasionally in the curled leaves of the apple.

The adult emerged from the cocoon in about 15 days, and lived in breeding cages for three or four days. The number of Aphids eaten per diem by the larva varied from 24 to 27. The temperature under which the experiments were conducted varied during the day between 60° and 80° F. and during the night between 40° and 50° F. The life-cycle under these conditions required an average period of 38 days.

BORDEN (A. D.). **The Mouth-parts of the Thysanoptera and the Relation of Thrips to the non-setting of certain Fruits and Seeds.**—*Jl. Econ. Entom., Concord*, viii, no. 3, June 1915, pp. 354–360, 1 plate.

The mouth-parts of the Thysanoptera are adapted for sucking and their food probably consists entirely of plant juices. Observations were made by the author on *Heliothrips haemorrhoidalis*, *Parthenothrips dracenae*, *Taeniothrips* (*Euthrips*) *pyri* (pear thrips), *Frankliniella* (*E.*) *tritici* and *E. occidentalis*. The feeding habits of the young were found to be similar to those of the adult. A detailed description of the mouth-parts is given. On deciduous fruits the thrips feed on the tender floral parts with very serious results to the setting of the fruit. The injured tissues turn brown and later black, often resulting in premature falling of the flower. When thrips occur in numbers, early-flowering almonds are only slightly damaged, but later flowering prunes, peaches, etc., are severely injured. In the Santa Clara Valley, peach orchards are commonly infested by *T. pyri*, *E. occidentalis*, *F. tritici*, and *Aeolothrips kuwanai*. *F. tritici* and *E. occidentalis* have been collected from lucerne; the young floral parts are attacked, causing the premature falling of the flower or young seed-pod.

LEONARD (M. D.). **Further Experiments in the Control of the Tarnished Plant-Bug** (*Lygus pratensis*, **Linn.**).—*Jl. Econ. Entom., Concord*, viii, no. 3, June 1915, pp, 361–367.

To test the efficiency of a fence in excluding *Lygus pratensis* from nurseries, wire screen cloth 6 feet wide was used to enclose an area 470 feet by 240 feet; this area contained peach trees and was surrounded on three sides by peaches and on the fourth by ornamenta trees. The soil was banked up 3 or 4 inches at the base in order to prevent any insects from crawling through open spaces at the bottom caused by irregularities in the ground. It had been previously observed that although the plant-bugs did not actually fly over the fence, from the surrounding weeds, they would fly on to the fence, crawl to the top and then fly into the enclosure. To prevent this, a strip of tanglefoot about 4 inches wide was placed along the upper edge of the wire cloth. Counts were made regularly of the number of bugs found within the enclosure and of the number of injured terminals of the trees. By 29th July, about 75 per cent. of the trees inside the enclosure were injured and counting was discontinued. On 8th November, about 95 per cent. were injured. By comparison with a control plot it was found that the fence excluded many bugs, but from the final condition of the trees not enough had been kept out to render its use practicable. Very few of the bugs alighted on the fence higher than 3 feet from the ground, and after crawling to the edge of the tanglefoot,

reached the inside of the enclosure by a short flight, only a small number being captured on the tanglefoot band. In July and August 1913, preliminary experiments were performed in protecting the terminals of peach trees by placing paper, mosquito netting and cheese-cloth bags over them. On June 18th 1914, uninjured tips were covered with unglazed paper bags. On 26th June the young tips of the trees were bent over, owing to the weight of the bags and the constant winds. The bags were removed on 30th June, when growth was found to have been impeded, and this method of protection was therefore abandoned. Pruning was begun on 29th July, the injured leader and a varying number of laterals being removed. Examination on 9th November showed unsatisfactory results, but about 12 per cent. of the trees had practically outgrown injury. Early pruning of the lower laterals at such time as most of the bugs had left the peach blocks seemed to give promise of assisting the trees to recover. Much depends on weather conditions and the amount of growth made by the tree after pruning.

FUNKHOUSER (W. D.). **Note on the Life-History of** ***Enchenopa binotata*****, Say (Membracidae), on the Butternut.**—*Jl. Econ. Entom., Concord,* viii, no. 3, June 1915, pp. 368–371.

Enchenopa binotata, Say, is widely distributed throughout the eastern United States. The most characteristic feature of the life-history of this species is the habit of covering the eggs with a frothy mass. The eggs are laid in two nearly parallel slits in the bark and the froth is placed over the slits in layers. This has been observed on *Celastrus scandens*, L. (bitter-sweet), *Robinia pseudacacia*, L. (locust) and *Ptelea trifoliata*, L. (hop-tree). On the butternut, *Juglans cinerea*, L., the eggs are laid at the base of, or in, the buds during the latter part of August ; they are seldom covered with the frothy deposit so characteristic of this species on other hosts. The earliest field record of the nymph is 3rd May ; the development of the nymph requires about six weeks. Adults appear in large numbers at the beginning of July, usually grouped about the petioles of the leaves. There is no evidence to show that the winter is passed in the adult stage. In the vicinity of Ithaca, N.Y., *E. binotata* is not attended by ants. It appears to be a species of considerable economic importance, since it has been reported on a wide variety of host plants and has been known to injure many of them seriously. In the case of the butternut, the buds are often destroyed and adventitious growths occur near the punctured buds which have failed to develop.

WEBSTER (R. L.). **Effect of Low Temperature on the Oyster-Shell Scale (*****Lepidosaphes ulmi*****, Linn.).**—*Jl. Econ. Entom., Concord,* viii, no. 3, June 1915, pp. 371–375, 3 figs.

During January 1912, the eggs of *Lepidosaphes ulmi* in many localities in Iowa were killed by the low temperature. Further data on the subject were obtained at the end of 1912 and in December 1914. In the latter year, many of the scales examined contained living eggs. There is a single generation annually, from the beginning of August until the middle of May, the eggs only being present beneath the

scales. Most of the reports of injury are from the northern half of the State, and although the scale occurs in the southern half, it is seldom harmful. Examination of scales during the winter of 1912–13 showed that a temperature of −32° F. killed the eggs. That they did not survive this temperature is shown by the fact that the scale did not breed in the area north of the −32° isotherm in the summer of 1912. Where the minimum temperature was −31°, many scales survived in the autumn of 1912. The accuracy of these figures requires further tests. In the winter of 1914–15, seven samples of scales examined showed no sound eggs. The insect had therefore not recovered from the check received three years before. In 24 localities, however, sound eggs were present.

GILLETTE (C. P.). **Confusion of** ***Rhopalosiphum hippophaes*****, Koch, and** ***Myzus bragii*****, Gillette.**—*Jl. Econ. Entom., Concord*, viii, no. 3, June 1915, pp. 375–379, 2 plates.

The distinction between *Rhopalosiphum hippophaës*, Koch, and *Myzus bragii*, Gillette, is recorded, as there has been a confusion of these species in Aphid literature. The following synonyms are given of *Rhopalosiphum hippophaës*, Koch, viz:—*Phorodon galeopsidis*, Pass., and *Myzus elaeagni*, del Guercio.

BRITTON (W. E.). **A Destructive Pine Sawfly introduced from Europe; *Diprion (Lophhyrus) simile*, Hartig.**—*Jl. Econ. Entom., Concord*, viii, no. 3, June 1915, pp. 379–382, 1 plate.

The larvae of *Lophyrus pini*, L., (*similis*, Hart.), which is one of the most injurious sawflies on European conifers, were found on 27th August 1914 at New Haven, Conn., upon the foliage of pine trees, though the means by which this pest was imported is unknown. The eggs are laid in slits made along one of the ridges at the edge of the needles. The full-grown larvae devour from 6 to 12 needles daily, preferring the old needles. There are two generations each year, the summer cocoon being formed on the trees and the autumn cocoon at their bases. In Europe, the destruction of needles, rubbish, etc., at the foot of the trees in autumn, is recommended. In Connecticut, the larvae have been found on *Pinus strobus* (white pine), *P. laricio* var. *austriaca* (Austrian pine), *P. flexilis* and *P. densiflora*. The trees were sprayed with lead arsenate in September.

KELLY (E. O. G.). **The Southern Corn Leaf-Beetle.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 221, 16th June 1915, 11 pp., 6 figs, 2 plates.

Observed in Louisiana maize fields in 1887 by F. M. Webster, *Myochrous denticollis*, Say (the southern corn leaf beetle), was first recorded as a serious pest of maize by the same entomologist from Ohio in 1900. Observations in Louisiana, Ohio, Kansas, Texas and Arkansas seem to indicate that the insect occurs in destructive abundance on lands that have previously been devoted to pasture or lands which have been allowed to lapse into a semi-wild condition, and provide hibernating quarters for the adults. The species is widely

distributed over the southern half of the United States. The eggs are deposited in clusters in pieces of weed, crevices and clods of dirt, but always near maize plants. A close search in the neighbourhood of other plants has failed to reveal them, although the beetles have been seen feeding on such plants at the time of oviposition. In the laboratory, incubation takes from 6 to 10 days, rarely 15 days. The newly-hatched larvae are about 1 mm. long, attaining at maturity a length of from 6 to 8 mm. Larvae have been found in the soil of maize fields where *Xanthium spinosum* (cocklebur) and maize were growing together, and where maize was growing alone, but in no other situation. The larvae were first found in small earthen cells at a depth of 4 to 6 inches, with a minute burrow leading towards the maize roots, which had been more or less eaten; the larvae retreated to safety and feigned death when discovered. All the outbreaks have occurred on the dark, waxy, second-bottom land which becomes very sticky in wet weather and very hard in dry weather. In sandy or light soils very few larvae or pupae have been found and correspondingly few injured maize roots have been observed. In latitude 26° N. the larval period probably extends from about 1st April to 15th June; in lat. 33°–34° it is delayed a fortnight and in lat. 37°, a further fortnight. The pupae mature in about 15 days. The adults are about $\frac{3}{16}$ of an inch long and are more or less covered with bits of soil. They are very rarely seen, owing to their habit of dropping from their food-plant to the ground and hiding when disturbed. The beetles mainly feed in the early morning, late evening, at night, or on cloudy days. They emerge from the pupal cells about the middle of July in central Arkansas and the 1st August in southern Kansas, emergence extending over about a month. They feed largely on the kernels of unripe ears of maize and buds of cocklebur before hibernating early in the autumn. Hibernation takes place under piles of maize husks, etc., in maize fields. In cotton fields the beetles were found in the open, unpicked cotton-bolls and beneath piles of recently picked cotton. Maize is the only crop seriously attacked; in the early spring the beetles attack very young cocklebur and early self-sown maize. Japan clover, crabgrass, sorghum, *Alopecurus geniculatus*, and cotton are also attacked. The beetles can fly considerable distances and do not necessarily hibernate in the field in which they breed. Great numbers have been taken at lights and, in the early autumn, it is possible that light traps would be effective against them. The cleaning up of all rubbish in the maize fields early in the autumn, especially in fields of late varieties, would prove an effective protection for the succeeding crop. When large numbers are observed in the vicinity of cotton gins, the use of the rubbish for boiler fuel, would destroy a great number of the beetles. Ordinarily the beetles attack a field of maize when it is very young and destroy it before the farmer becomes aware of their presence. No remedy exists for controlling them once they have entered a maize field. A badly damaged crop may be replanted with safety about one month after the regular planting time, as the beetles leave the field within a few days of destroying the first planting. This, taken together with the fact that the beetles appear and disappear with considerable regularity from south to north, seems to indicate that something might be gained by delaying planting in localities where injury has been done in the previous year. The

beetles appear to leave their winter quarters in early spring, oviposit near young maize plants and feed upon these during the prolonged period of oviposition. This leads to the somewhat anomalous assumption that the parent beetle, under stress of hunger, destroys the food-plant of the larvae. If true, this would account for the very erratic occurrence of the outbreaks. According to Mr. E. H. Gibson, the beetles can be readily destroyed by a poisoned-bran bait, consisting of 25 lb. of wheat bran, 1 lb. of Paris green, 1 U.S. gal. of low-grade molasses, the juice of three oranges, with enough water to bring the mixture to a stiff dough. This is best applied in the late afternoon. A bibliography of eight works concludes this paper.

PARKER (W. B.). **Control of Dried-Fruit Insects in California.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 235, 24th June 1915, 15 pp. 4 figs., 7 plates.

The most common and destructive insect pests of dried fruit on the Pacific coast are *Plodia interpunctella*, Hb. (Indian-meal moth) and *Carpophilus hemipterus*, L. (dried-fruit beetle). Other species are: *Ephestia cautella*, Walk. (fig moth), *Silvanus surinamensis*, L. (saw-toothed grain beetle), *Cathartus advena*, Waltl (foreign grain beetle), a fungus beetle, *Henoticus serratus*, Gyll., and the sugar mites, *Tyroglyphus siro*, Gerv., and *T. longior*, Gerv. Machines have been invented which will successfully pack and seal small packages of dried fruit at a moderate cost and it is probable that it will soon be as necessary to pack dried fruit in that form as it is to pack cereals [see this *Review*, Ser. A, ii, p. 93.]

FINK (D. E.) **The Egg-Plant Lace-Bug.**—*U. S. Dept. Agric. Washington, D.C.*, Bull. no. 239, 24th June 1915, 7 pp., 6 plates.

The Tingid, *Gargaphia solani*, sp. n., is a new enemy of the egg-plant and related plants. In Virginia, it feeds extensively on the former, causing the leaves to turn yellow and finally shrivel up. All stages may be found on the underside of the leaves, and, especially in the nymphal stages, the bugs feed in original colonies as hatched. The nymphs migrate from one leaf to another, injuring every leaf attacked, until they transform, after which, as adults, they disperse to other plants. During the summer of 1914, the injury in many egg-plant fields near Norfolk, Va., was estimated at from 10 to 15 per cent. This insect is not yet generally recognised as a specialised egg-plant pest owing to the fact that the injury closely resembles that due to Aphids, which are usually present about the same time. The egg, nymph and adult are described. The species appears to be a native of America and to have a distribution ranging from the South Atlantic coast to the South-western States. It has been recorded on *Solanum carolinense*, *S. elaeagnifolium* and *Cassia* sp. (coffee weed). Early in spring, almost as soon as egg-plants are planted out, the hibernating adults begin to infest them and establish colonies. Adults and eggs were found as early as 20th May. The adults reproduce and feed during the entire summer on the egg-plant, but migrate to *Solanum carolinense* (horse nettle) during the latter part of August and the first

week in September, when the season for egg-plants is nearly over. Here they continue breeding until the cold weather sets in. The adults hibernate in the shrivelled leaves or in the ground under débris. In the field, the egg-laying period lasts from four to five days. The minute greenish eggs are deposited on the underside of the leaves in circular masses, incubation lasting from five to seven days. When the young migrate from one leaf to another the female parent usually directs the way and guards her offspring. On one occasion, a Coccinellid, *Hippodamia convergens*, was observed to be driven off on its approaching a brood. The nymphs pass through five distinct moulting periods, the total nymphal stage occupying about 10 days. The total life-cycle of this lace-bug occupies approximately 20 days. From seven to eight generations occur in a breeding season of nearly six months. Apparently six generations live on the egg-plant and the remainder on the horse nettle. Most of the generations in the field overlap. Natural enemies include the Coccinellids, *H. convergens* and *Megilla maculata*, which, both in the larval and adult forms, feed on the nymphs and adults. A common soldier-bug, *Podisus maculiventris*, Say, feeds on the nymphs, which are also preyed upon by *Triphleps insidiosus*, Say. Three spiders, *Epeira domiciliorum*, Hentz, *Plectana stellata*, Hentz, and *Chiracanthium inclusum*, Hentz, were observed feeding on all stages of the lace-bugs. Satisfactory results were obtained in a series of spraying experiments. The best solution was one containing 8 lb. of fish-oil soap in 50 U.S. gals. of water. This killed 100 per cent. of the nymphs and 95 per cent. of the adults. A spray containing nicotine sulphate, but less fish-oil, proved inferior. Too much emphasis cannot be laid on the thoroughness with which the spray must be applied, especially on the underside of the leaves.

GIBSON (E. H.). **The Sharp-headed Grain Leafhopper.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 254, 29th June 1915, 16 pp. **1 fig., 6 tables.**

Draeculacephala mollipes infests cereal and forage crops throughout the United States. Nymphs and adults have been taken from wheat, barley, oats, lucerne, *Medicago denticulata*, *Sorghum halepense*, etc. Adults alone have been found on kafir corn, sorghum, cowpeas, vetch and Bermuda grass. The chief damage is done to young grain crops in autumn and early spring, direct injury being caused by the feeding of nymphs and adults, which puncture leaf and stem tissue and suck the juices from them. Early stages of injury are indicated by the yellowing of the tissue around the feeding punctures. This is followed by a drying up of the tissue, which turns reddish brown, giving the leaf or stem a spotted appearance. The life-cycle comprises three stages. The eggs are deposited in pockets below the epidermis of the stem or leaf and, under Arizona conditions, hatch in from 3 to 35 days. The average duration of the nymphal stage is 30 days. The number of generations annually, varies from two to six. Hibernation seems to occur in all stages from egg to adult, although the majority of individuals pass the winter in the adult condition, at least in the Southern States. Both nymphs and adults are extremely active, especially on warm sunny days. Oviposition takes place about 10 days after copulation,

and may extend over from one to three weeks. Only the nymphs of the last two instars can adapt themselves to a change of food-plant. This fact offers a suggestion in the control of the species. Since the adult is not affected by change of food, migration takes place entirely in this stage. The most effective enemies of the leaf-hopper are its egg parasites, two species of which, viz., *Gonatocerus gibsoni* and *Abbella auriscutellum*, have been reared. *Abbella* (*Brachistella*) *acuminata* and *Ufens niger*, also parasitic in the eggs, have been found in Florida. *Reduviolus ferus* and the ant, *Pogonomyrmex barbatus*, are predaceous upon the adult. A fungoid disease caused by *Empusa grylli* frequently attacks this species. An artificial control measure consists of cutting or otherwise removing broad-leaved grasses, which afford the summer food. The ground should be broken up and planted as soon as possible after harvest. If immediate planting is not practicable, all native grasses should be kept down by reploughing. Direct treatment consists in the use of the hopperdozer, formed from a sheet-iron strip coated with coal tar. The apparatus is drawn over the grass, the insects falling upon the tarred surface, and it can be used with advantage while the grain is short. Where the pest is infesting grass land, close cutting while in the egg-stage is advised; this would prove beneficial in the Northern States, where the egg-stage lasts several weeks. The burning of grasses in which the insects may be hibernating would destroy many of the adults.

Kelly (E. O. G.). **A New Wheat Thrips.**—*Jl. Agric. Research, Washington, D.C.*, iv, no. 3, June 1915, pp. 219–224, 1 plate.

Prosopothrips cognatus, Hood, frequently becomes injurious to wheat in localised areas, but has not yet been found attacking oats or other grain crops. It occurs in Kansas, Oklahoma, Missouri, and southern Nebraska. The female cuts the tissue of the young leaves of wheat or grass, usually on the ventral side, and places a single, minute egg in each puncture. The hatching period varies from 6 to 10 days. The full-grown larva is green in colour and measures from about 1 mm. to 1·2 mm. in length. The larval stage lasts from 10 to 12 days, and the larva then crawls down the plant into the soil, where it pupates. There is no indication of the yellow colour of the adult when the larva enters the soil. The complete life-cycle from egg to adult requires from 30 to 35 days. The adults emerge from their winter quarters as soon as the warm days of spring arrive. Although the length of life of an adult has not been definitely determined, a few have lived 8 months in the laboratory. There are four to five generations a year. These overlap each other, so that adults and larvae are present at all times, even in late winter. The larvae are most numerous in the spring, late summer and late autumn. They feed until the cold weather causes them to hibernate. During the interval between the wheat harvest in June and the sprouting of self-sown wheat in August, the thrips feed and reproduce on *Agropyron smithii*, *Elymus canadensis*, *E. virginicus*, *Syntherisma sanguinalis*, *Panicum crus-galli* and *Hordeum jubatum*. They are found on these grasses all the year round, but more especially during the period mentioned. The injury is confined to the leaves of young plants, unfolding heads and newly formed grains of wheat, and the young

unfolding leaves of some grasses. When attacked by a dozen or more individuals at one time, the leaves become badly mutilated in a few hours and soon acquire a rusty appearance. The injury often becomes serious by preventing the new shoot from developing. The heads are first attacked when in blossom, the pollen being eaten and the stamens and pistils badly damaged, so that destruction of embryo seeds occurs. As soon as the grains begin to form, the thrips attack the husk, and later the tender integument of the newly forming grain, remaining on the wheat head until it becomes dry. Both adults and larvae have been found hibernating beneath the sheaths of the following grasses: *Andropogon scoparius*, *A. furcatus*, *Poa pratensis*, *Agropyron smithii* and *Tripsacum dactyloides*. None of the stages of this pest have been found hibernating in *Panicum crus-galli* or *Syntherisma sanguinalis*, which become quite dead and dry after the first frost. *Triphleps insidiosus*, Say, and the larvae of *Chrysopa oculata*, F., are among the more important enemies of *P. cognatus*. No Cocinellids or birds have been observed feeding on them and no parasites have been reared. No really practical remedy can be suggested for the control of this pest. Where possible, the burning off of all grasses will destroy large numbers. Early ploughing appears to be useful, and fields ploughed in June and harrowed in July, were less attacked; they contained practically no self-sown wheat. These measures give less opportunity for the thrips to increase in numbers sufficient to damage the crop.

PARKER (J. R.). **Influence of Soil Moisture upon the Rate of Increase in Sugar-Beet Root-Louse Colonies.**—*Jl. Agric. Research, Washington, D.C.*, iv, no. 3, June 1915, pp. 241–250.

Outside fields of the sugar-beet (*Beta vulgaris*), the subterranean form of the sugar-beet root-louse, *Pemphigus betae*, Doane, is most commonly found upon lamb's-quarters (*Chenopodium album*, L.) growing in dry situations; in damp situations it is rarely heavily infested. In the beet fields it has often been noticed that the Aphids are most abundant and that injury first appears where the soil is driest. A striking illustration of this was observed in a large sugar-beet field which was cut diagonally by a depression in which the ground remained moist without irrigation during the entire summer. In October, beets were growing well in the moist soil and no Aphids could be found upon them, while in the drier soil, around the borders of the depression, every plant was heavily infested. From a large amount of data, it seems safe to assume that soil moisture is a very important factor in controlling the rate of increase in colonies of this pest. During the first year's experiments irrigation greatly reduced the numbers, and it is hoped that a system of irrigation may be arrived at which will reduce injury by *P. betae* to a negligible amount without interfering with the approved cultural methods. The principal immediate source of infestation of sugar-beets is the presence of the cottonwoods, *Populus balsamifera*, L., and *P. angustifolia*, James, upon which the Aphid develops galls in the spring. During the latter part of June and early July, some of the numerous migrants fly from the galls to the sugar-beets, where they deposit living young, which descend to the roots and start new colonies. It has been found very difficult to induce the progeny of migrants to colonise upon sugar-beets in soil

of which the surface is at all moist. The only successful attempts in colonisation have been where sugar-beets were sub-irrigated and several inches of dry soil kept at the surface. It therefore seems highly important that sugar-beet fields should not be allowed to become dry during the period when *P. betae* is migrating to them. This is frequently just the time when, in ordinary practice, these fields are allowed to become quite dry. Instances on record show that, irrespective of Aphids, early and frequent irrigation is the right treatment for obtaining the highest sugar content and tonnage. Plenty of moisture should be maintained throughout the growing season, as this will prevent the increase of such individuals as have succeeded in becoming established in the fields, even if well irrigated.

CRAIGHEAD (F. C.). **Larvae of the Prioninae.**—*U. S. Dept. Agric., Washington, D.C.*, Report no. 107, 25th June 1915, 24 pp., 8 plates.

Cerambycid larvae are probably without exception phytophagous, mainly boring in the ligneous tissue of trees, although a few species are confined to herbaceous plants, in which case they are usually pith or root feeders. Some species have a wide variety of host plants, while others are limited to a single genus or species. Great diversity is shown in feeding habits and larval mines; some bore exclusively in decayed moist wood, others in dead, dry wood, and many under the bark of living trees. The manner of oviposition also varies. Many forms lay their eggs in crevices of the bark; others insert them into the soft wood; in some cases, e.g., *Parandra*, it is probable that the adults do not emerge, but pair and oviposit in the wood in which they are working. The life-cycle usually lasts for a year, although in some cases from two to three years is the normal period. A detailed description of the genera of the sub-family PRIONINAE is given. The larva of *Parandra* is typically a heartwood feeder, attacking nearly all eastern coniferous and hardwood trees. It normally attacks the lower trunk, gaining entrance through a wound. This species has been recorded as a serious pest of park and shade trees, as well as of telegraph and telephone poles. *Mallodon dasystomus*, Say, has been taken from willow, oak and box. *Archodontes* (*M.*) *melanopus*, L., bores into the living roots of oak, causing the formation of a large gall and often killing the trees or giving rise to a stunted growth. The larva of *Orthosoma* is found in dead and decaying logs of practically all arborescent species of eastern hardwoods and conifers. It is chiefly of economic importance owing to the destruction it causes to telegraph and telephone poles and other timbers in contact with the ground. *Ergates spiculatus*, Lec., attacks dead or decaying coniferous logs. The mines are very large, extending through both sapwood and heartwood. The principal flight of the adult is in July and August. *Prionus imbricornis*, L., occurs throughout the eastern and central States on the living roots of oak and chestnut. The adults fly from June to August. In West Virginia it is especially destructive to chestnuts, causing the death of the tops and branches. The females lay eggs in groups about the base of the tree. The young larvae feed in the bark before penetrating into the heartwood of the root. The larval stage extends over at least three years. *P. laticollis*, Drury,

attacks the roots of living oak, poplar and chestnut, and is often associated with *P. imbricornis*. *P. californicus*, Motsch., causes the death or stunts the growth of California black oak, Garry white oak, western cottonwood, white alder and madroña. The larvae bore into the bark at the base of the tree, and when about an inch long, penetrate the roots. *Sphenostethus taslei*, Buquet, breeds in moist situations; the larva bores into dead oak, chestnut, *Cercis canadensis* and many other hardwoods.

FUNKHOUSER (W. D.). **Life-History of** *Thelia bimaculata*, **Fab., (Membracidae).**—*Ann. Entom. Soc. America, Columbus*, viii, no. 2, June 1915, pp. 140–152, 1 plate.

Thelia bimaculata is abundant on *Robinia pseudacacia* in the vicinity of Ithaca, N.Y. The insects may be found in large numbers from early spring to late autumn. Migration is evidently slow. The nymphs are usually found in the crevices of bark near the ground; the larger individuals migrate upwards and are found in the axils of a twig or leaf. They are always attended by large numbers of ants. Pairing and oviposition takes place from July to November, the eggs being laid at the base of the trunk in the cambium. The first nymphs appear late in May; the total period from egg to adult is about a month. Feeding takes place in early morning on twigs of the second or third year's growth. *R. pseudacacia* seems to be the only host in this locality. Parasitism is common in the eggs, and the bodies of nymphs and adults often contain larvae, apparently Hymenopterous. The following species of ants attending on nymphs and adults have been identified:—*Formica obscuriventris*, *F. exsectoides*, *Camponotus pennsylvanicus*, *Cremastogaster lineolata*, and *Prenolepis imparis*. Injury to the host plant appears, up to the present, to be negligible.

MARCOVITCH (S.). **Biology of the Juniper Berry Insects, with Descriptions of New Species.**—*Ann. Entom. Soc. America, Columbus*, viii, no. 2, June 1915, pp. 163–188. 7 plates.

In 1913, some deformed berries of *Juniperus virginiana* were found to contain an Eriophyid mite, *Eriophyes quadrisetus typicus*. Other berries sent from Newark, Del., were injured by *E. quadrisetus juniperus*. The winter is spent by the mites inside the green berries. In spring, the young ovules are attacked and eggs are laid within them. The production of young is continuous throughout the growing season. During October, the mites collect in certain berries where they pass the winter. *Eurytoma juniperinus* (juniper berry Chalcid) feeds in the fleshy part of the berry, and never in the seed tissue. There is one generation a year and the winter is passed in the larval stage. Pupae and adults have been found late in May. The larvae are abundant in mite-infested berries. The larvae of *Geniocerus juniperi* feed on the fleshy part of the berry. There is one generation a year; the larval stage persists throughout the winter. A parasitic larva has been found in contact with a larva of *G. marcovitchi*. There are apparently two generations of this parasite annually. *Rhagoletis juniperinus* was found in September 1913. From the larvae kept under observation, a fly emerged on 6th April. Females were

found ovipositing on 21st August. The larvae from these eggs pupated about 9th October. The larvae of *Argyresthia alternatella* occur within the seeds. Moths were observed on 24th May and eggs on 6th June. The mature larva feeds on the fleshy part of mite-infested berries. The majority of larvae became mature on 25th September. The natural enemies include *Secodella* sp., *Protapanteles* sp., and members of the family ENCYRTIDAE. Berries growing near St. Paul contained a Cecidomyid larva, together with a *Tetrastichus* larva in the same cell.

SURFACE (H. A.). **For Walnut Caterpillars.**—*Zool. Press Bull., Penns. Dept. Agric., Harrisburg*, no. 321, 21st June 1915.

For controlling *Datana integerrima*, S. and R., (walnut red-necked caterpillar), attacking the foliage of black walnut trees, a spray containing 1 oz. of lead arsenate in a gallon of water is recommended. It is also feasible to burn them, provided that the burning is slight and quickly done, so as not to damage the branches; injury to the foliage is not serious. These caterpillars have a peculiar habit of coming down the trunks in large bunches and clinging together while they moult; such bunches should be destroyed. These remedies are also suitable for the very similar species which attacks the apple, the red-necked apple caterpillar (*Datana ministra*, Dru.).

HARNED (R. W.). **Blister Beetles.**—*Mississippi Agric. Expt Sta.*, Press circ., 9th June 1915.

The MELOIDAE or blister beetles attack tomatoes, potatoes, beans and other garden and field crops in Mississippi. The insects appear in large numbers in the year following an outbreak of grasshoppers, upon the eggs of which the larvae of the beetles feed. Lead arsenate dusted upon the plants or used as a spray at the rate of 1 lb. of paste to 15 gals. water or Bordeaux mixture has been found satisfactory. Paris green and lime as a dust or spray gives good results. Hand picking or driving into a ditch coated with oil is often practicable. To prevent further outbreaks, it is advisable to take steps to control the grasshoppers [see this *Review*, Ser. A, iii, p. 263].

HARNED (R. W.). **The Corn Stalk Beetle.**—*Mississippi A. & M. College Extension Service, Agric. Coll.*, Press circ., 19th June 1915.

The corn stalk beetle [*Ligyrus rugiceps*] has recently been very abundant in Mississippi. Injury is caused by the beetles eating into the stalks of the maize plants close to the ground. When the plants are young, the stalk is severed, while older plants are injured so that they soon wither. There is one generation a year. The eggs are laid on or near the roots of maize, sugar-cane or other members of the grass family. The larvae feed on the roots until autumn, when pupation takes place. The adult emerges in the following spring. Deep autumn and winter ploughing, crop rotation, hand picking of adults in spring and allowing pigs to feed in badly infested fields, have proved suitable remedies.

Lüstner (G.). *Incurvaria* (*Lampronia*) *rubiella*, **injurious to the Raspberry** (*Rubus idaeus*) **in Germany.**—*Mthly. Bull. Agric. Intell. & Plant Dis., Rome*, vi, no. 6, June 1915, p. 893. [Abstract from *Deutsche Obstbauzeitung, Stuttgart*, no. 7, 1st April 1915, pp. 90–91, 2 figs.]

The injury caused to raspberry canes by *Incurvaria rubiella*, Bjk., may be checked by removing and burning the attacked shoots. In the spring, when the new shoots are growing, several buds lying one above the other fail to develop. They at first retain their green colour, but later on turn brown, wither and finally fall or decay. As a consequence, the foliage of the new shoots is very scanty and thin. As these symptoms will occur at the beginning of spring, they are likely to be confused with those produced by the cold. If a shoot bearing buds which have failed to develop be cut in half, a gallery may be seen which runs from the pith towards the bud and is the work of the larva of this pest.

Kirk (T. W.). **The Fruit-Fly.**—*Jl. Agric., Wellington, N.Z.*, x, no. 5. 20th May 1915, p. 456. [Received 20th July, 1915.]

A proclamation recently issued in South Australia enacts that no fruit of any tree or plant shall be introduced into South Australia from the States of Queensland, New South Wales, and Western Australia, in the Commonwealth of Australia, unless accompanied by a certificate, signed by an Inspector of orchards stationed in the district wherein such fruit was grown in the exporting State, setting out and declaring the following facts:- (*a*) That no fruit-fly has been known to exist for the two years previous to the signing of such certificate in the orchard from whence such fruit was picked or packed. (*b*) That no fruit-fly has been known to exist in any orchard or garden within five miles of the land on which the said fruit was grown.

The New Zealand regulation requires a declaration that no fruit-fly is known to exist in, or within one mile of, the orchard where the fruit was grown.

Ballou (H. A.). **Report by the Entomologist.**—*Dept. Agric. for the West Indies, St. George, Grenada*, 26th April 1915, 11. pp. [Received 24th July 1915.]

The following observations were made during a visit to Grenada in February and March 1915: *Heliothrips rubrocinctus* (cacao thrips) is permanently present and generally distributed in Grenada, and occurs year after year in the same localities, in the same portions of the cacao plantation and perhaps on the same trees. It is most abundant during the last three months of the year in those estates which lie on the lower lands around the periphery of the island; in the dry months a considerable improvement in the condition of the trees takes place. This is contrary to the state of affairs prevailing in other countries. In Grenada thrips may be present in cacao for several years and never increase in numbers sufficiently to attract attention. The attacks of thrips indicate that something is wrong with the plant or with the conditions under which it is growing. The patches examined suffered from root disease, bad drainage or unfavourable soil conditions.

Permanent thrips control will result from the eradication of root disease, and better drainage and soil conditions, rather than from spraying. *Stirastoma depressum*, L. (cacao beetle), which is a well-known pest causing some damage in Grenada, is not confined to any special area of the island, though it is more abundant on the leeward side. Better methods of pruning will probably help in reducing the amount of injury. Extended use of traps and possibly spraying with lead arsenate may be found of value. *Cremastogaster* sp. (acrobat ant) is recorded for the first time as damaging cacao. It is possible that this may become the most serious cacao pest in Grenada owing to (1) the unlimited nesting sites available in crevices of bark or wood in living or dead trees, in fences and out-buildings; (2) the small size of the colonies; (3) the method of feeding in cuts or wounds, in such a manner as to prevent these from healing over; and (4) the association of these ants with other insects, especially with *Pseudococcus citri* (mealy bug). Attacks are encouraged by bad pruning and careless treatment of borer wounds and all decayed trees. Experiments should be made with a view to finding some better wound dressing than any now in use. Black blight on cacao trees is generally associated with mealy bugs and scale-insects, but is in itself comparatively harmless to the trees. Two species of COCCIDAE attack cacao in Grenada, viz., *Pseudococcus citri* (mealy bug) and *Asterolecanium pustulans* (fringed scale). There seems to be no danger that any insects known to occur in Grenada which are accompanied by black blight will eventually become pests of cacao. Scale-insects are there controlled to a certain extent by natural enemies, both fungi and insects, the latter being mainly Hymenopterous parasites.

NOWELL (W.). **Report by the Mycologist.**—*Dept. Agric. for the West Indies, St. George, Grenada*, 26th April 1915, pp. 12–17. [Received 24th July 1915.]

Owing to the rarity in Grenada of scale-insects, except mealy bug on cacao, observations on the subject of fungi parasitic on scale-insects were confined to citrus, mango and other fruit trees. Mangoes were found to be infested with *Lecanium* sp., and *Cephalosporium lecanii* (shield scale fungus) was widespread. The practice of pruning trees for removal of black blight is unjustifiable, since it involves the destruction of *C. lecanii*. The question of the artificial distribution of useful fungi only arises in the case of shield scales on mango and other fruit trees. The introduction into such trees, at the beginning of the wet season, of branches containing *C. lecanii* would probably give better results than the lopping of the trees. The success of the measure should be judged by the condition of the scales and of new shoots, not by the black deposit on the old leaves, which may remain long after the cause of it has been removed.

DU PORTE (E. M.). **Some Insect Parasites of the Bud Moth.**—*7th Ann. Rept. Quebec Soc. Prot. Plants from Insects and Fung. Dis. (1914–1915), Quebec, 1915*, pp. 76–77. [Received 4th August 1915.]

In the summer of 1914, the author obtained four Hymenopterous parasites from the bud moth (*Eucosma ocellana*), which have been

identified as *Pimpla* (*Itoplectes*) *conquisitor*, Say, *Microdus* (*Bassus*) *earinoides*, Cress., *Opius* (*Biosteres*) sp. and *Trichogramma minutum*, Riley, (*pretiosa*, Riley). Of these, *M. earinoides* is the only one which has previously been recorded as a parasite of the bud moth. *T. minutum* was reared from the eggs, the others from the pupae. When parasitised the eggs assume a deep, shiny black colour. *T. minutum* is the most abundant and will very likely soon check the increase of the bud moth. From 21st July to 3rd August inclusive, the author collected 1,359 eggs from various orchards, 77 per cent. of which were parasitised by *P. minutum*. According to Taschenberg, the following parasites of this pest occur in Europe :—*Chelonus nigrinus*, *C. similis*, *Microdus rufipes*, *Mesochorus dilutus* and *Lissonota culiciformis*. Slingerland gives the following as occurring in the United States :—*Phytodictus vulgaris*, Cr., *Pimpla* sp. near *alboricta*, Cr., and *Microdus laticinctus*, Cr. The last-named has also been reported from Canada.

Du Porte (E. M.). **Two Bacterial Diseases of Injurious Insect Larvae.** —*7th Ann. Rept. Quebec Soc. Prot. Plants from Insects and Fung. Dis.* (*1914–1915*), *Quebec, 1915*, pp. 81–85, 1 fig. [Received 4th August 1915.]

From diseased caterpillars of *Malacosoma americana* (the orchard tent caterpillar) the author obtained cultures of an organism pathogenic to them. Experiments were also tried to determine whether infection could be spread by spraying the germs on the food-plants, but the results were not conclusive. In 1914, Professor Zoe Northrup, of Michigan Agricultural College, described a bacterial disease of June beetle larvae, *Lachnosterna* spp., caused by *Micrococcus nigrofaciens*, Northrup [see this *Review*, Ser. A, ii, p. 639]. This *Micrococcus* is usually accompanied by a putrefactive organism, a gas-producing bacillus, which Miss Northrup regards as being probably *B. septicus insectorum*, Krassilstchik. With a view to discovering whether the organism occurs as a parasite of the white grub in Quebec soils and is virulent to local forms, a series of experiments were made which, though incomplete, render it probable that *Micrococcus nigrofaciens* is present in Quebec and that the putrefactive organism may cause death even when not associated with *M. nigrofaciens*. The latter conclusion is not, however, regarded as definitely proved, as it is possible that tissues which are attacked by the putrefactive bacillus are already diseased.

Swaine (J. M.). **Shade Tree Insects in Quebec.**—*7th Ann. Rept. Quebec Soc. Prot. Plants from Insects and Fung. Dis.* (*1914–1915*), *Quebec, 1915*, pp. 91–115, 13 figs. [Received 4th August 1915.]

The most important of the insect pests attacking shade trees are :—*Eriosoma americanum* (elm woolly aphis), *Gossyparia spuria* (elm bark louse), *Malacosoma disstria* (forest tent caterpillar), *Datana integerrima* (black walnut caterpillar), *Asterolecanium variolosum* (golden oak scale), *Hemerocampa leucostigma* (white-marked tussock moth), *Hyphantria textor* (fall webworm), *Agrilus anxius* (bronze birch borer), *Cyllene robiniae* (locust borer), *Saperda calcarata* (poplar borer), *Podosesia syringae* (lilac borer), *Elaphidion villosum* (oak twig pruner),

Prionoxystus robiniae (carpenter worm), *Aegeria* (*Sesia*) *acerni* (maple sesia), *Plagionotus speciosus*, *Chermes pinicorticis* (pine bark aphis), *Pissodes strobi* (white pine weevil), *Chermes similis* and *C. abietis* (spruce gall aphids), *Tortrix fumiferana* (spruce bud-worm), *Lophyrus abietis* (spruce or fir saw-fly), *Coleophora laricella* (larch case-bearer), *Chermes strobilobius* (larch woolly aphis), *Lygaeonematus erichsoni* (larch saw-fly) and *Mindarus abietinus* (balsam twig aphis).

LOCHHEAD (W.). **Useful Keys to some Economic Families of Insects.** —*7th Ann. Rept. Quebec Soc. Prot. Plants from Insects and Fung. Dis.* (*1914–1915*), *Quebec*, *1915*, pp. 135–142. [Received 4th August 1915.]

These keys refer to certain genera of economic importance in the following families :—SPHINGIDAE, TABANIDAE, TRYPETIDAE, CERAMBYCIDAE, CURCULIONIDAE, SCOLYTIDAE, BLATTIDAE, ACRIDIIDAE, TETTIGONIIDAE and GRYLLIDAE.

CROSSMAN (S. S.) & WOLCOTT (G. N.). **Control of the Changa.**—*Porto Rico Agric. Insular Expt. Sta., Rio Piedras*, Circ. no. 6, 1915, 3 pp.

After numerous experiments covering a period of several years, a very easy, cheap and effective method of destroying the "changa" or mole-cricket (*Scapteriscus didactylus*, Latr.), which is so injurious to tobacco, sugar-cane, and vegetable crops in Porto Rico [see this *Review*, Ser. A, i. pp. 185 and 324], has been discovered as the result of a suggestion made by an official of the Porto Rico Leaf Tobacco Company. A poison-bait was prepared with 100 lb. of low grade flour and $2\frac{1}{2}$ or 3 lb. of Paris green. The bait was then placed in a ring around the tobacco plant which it was intended to protect, in a shallow trench about 1 inch deep and 3 inches from the plant. Care should be taken not to place the bait nearer than this to the plant or to drop any on the leaves, as it scorches the plant severely. In a vegetable garden, broadcast distribution is more suitable, the bait being scattered at the rate of from 250 to 300 lb. per acre. The area to be treated must be first ploughed and thoroughly broken up, so as to be as free as possible from vegetable matter at the time the mixture is applied, which should be not less than a week later. Four or five days should then be allowed before planting, to give the mole-crickets ample time to feed and die. This method was tried on tobacco and would be just as effective with any other crop, such as sugar-cane or vegetables, and is easier of application than the ringing system. A sufficient quantity of bait to destroy all the mole-crickets on an acre of tobacco by either of the two methods is 300 lb., and the cost, including labour, is from 32 to 40 shillings. This bait is now extensively used in Porto Rico.

HORTON (J. R.). **Control of the Citrus Thrips in California and Arizona.** —*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 674, 8th July 1915, 15 pp., 7 figs., 1 table.

Scirtothrips (*Euthrips*) *citri* during the past few years has done serious damage to citrus fruits in the San Joaquin Valley of California.

In seasons such as 1911, when investigations on the life-history were being carried on, adult thrips appear in April and increase rapidly during April and May, when the insects are largely congregated on the fruit and foliage. From June to August they disperse over miscellaneous food-plants. In August and September, migration back to the citrus fruit takes place. The eggs deposited on stem and leaves hatch during the following March or April. The average duration of the egg-stage in summer varies from 10 to 18 days during May and June, from 6 to 8 days in July and August and from 17 to 18 days in September and October. The length of the larval stage varies from 6 to 13 days, and the pupal stage from 4 to 19 days. Pupation takes place in crevices of bark, under dead leaves, etc. The most effective method of control is the application at high pressure of contact insecticides, preferably those containing sulphur. Commercial lime-sulphur of a density of 33° Bé. should be diluted with 50 times its volume of water. Soda-sulphur solution gives equally good results. Commercial tobacco extract should be used at the rate of 1 part in 800 parts of water. The greatest injury to the fruit is done between the time the petals fall and when the fruit is half grown. Three applications of insecticide are necessary during this period. The first should be made when about four-fifths of the petals have fallen, the second from 10 to 14 days later and the third from 2 to 4 weeks later still. A fourth spray should be given in late August or September. Nursery stock requires from 3 to 5 applications during the season, the first being made between 15th April and 15th May. A table of the quantities of liquid required is given, together with a short description of spraying apparatus and cost of materials.

Brooks (F. E.). **The Roundheaded Apple-Tree Borer.**—*U. S. Dept, Agric., Washington, D.C.*, Farmers' Bull. no. 675, 6th July 1915. 20 pp., 19 figs.

The range of *Saperda candida* (roundheaded apple-tree borer) in the United States is bounded by a line extending from near the mouth of the St. Lawrence westward to Minnesota, thence through Nebraska, Kansas, Louisiana, Mississippi, Alabama and Georgia to the Atlantic coast. This line, except in its south-western extent, bounds the distribution of the service tree, a favourite host of the borer. Orchards near which service, wild crab or mountain ash trees grow, are thus very liable to injury. Among cultivated fruits, apple, quince and pear are most subject to attack. The adults issue from the trees in late spring and early summer. Egg-laying begins about 10 days after emergence and is continued for 40 or 50 days, each female depositing from 15 to 30 eggs. The eggs are placed in incisions in the bark, either above or just below the soil. On hatching, the larvae attack the inner bark, then bore into the sapwood in an upward direction. The adult stage is reached in the third year. The pupal stage occupies about three weeks ; the beetle emerges from the tree by a circular hole eaten through the bark. The adults feed on the bark of twigs and on the midribs and stems of leaves, and to some extent on the moisture contained in the castings thrown from the trees by the larvae. The average life of the beetle is about 40 or 50 days. The natural enemies include certain birds and a Hymenopterous parasite, *Cenocoelius populator*.

The control methods used are the removal of the larvae from the burrows by means of a knife, the fumigation of the tunnels by means of carbon bisulphide, the destruction of wild host plants in the vicinity of the orchard, and the use of various paints and washes. Kerosene applied to the trunks is liable to injure the bark. A thick coating of white lead paint and raw linseed oil for a distance of about 1 foot up the trunk and 2 or 3 inches below the soil is very effective in preventing the female from depositing eggs in the bark. Mechanical protectors, in the form of wrappers of paper, cloth, or fine-meshed wire netting, answer a similar purpose. Such protectors should be placed round the top of the trunk to prevent the beetles from crawling down to oviposit. Spraying with arsenicals will kill many of the adults.

MARLATT (C. L.). **The Silverfish; an injurious Household Insect.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 681, 14th July 1915, 4 pp. 2 figs.

Lepisma saccharina (silverfish) is an enemy of books, paper, starched clothing and occasionally of stored food substances. An allied form, *Thermobia domestica*, frequents ovens and fireplaces and can stand temperatures which would be fatal to another insect. Cardboard covered with a layer of starch paste to which white arsenic has been added, is an effective bait, while pyrethrum and sodium fluoride can be successfully used on books, papers, etc.

WEBSTER (F. M.) & KELLY (E. O. G.). **The Hessian Fly Situation in 1915.**—*U.S. Dept. Agric., Washington, D.C.*, Circ. no. 51, 2nd July 1915, 10 pp., 5 figs.

It is pointed out that, at the date of publication of this circular, all measures against the Hessian fly (*Mayetiola destructor*) have the object of protecting the wheat to be sown during the months of September and October. No wheat should be sown in August. Figures are given to enable farmers to recognise attacks; one series of twelve pictures illustrates the seasonal development of the fly throughout the year, and another is an outline map of the United States, the area between 41° N. latitude and 33° N. latitude being marked with the approximate dates after which, under normal conditions, wheat may be sown without fear of serious attack. These dates extend from 10th September to 1st November. The usual control measures are described.

LEVISON (J. J.). **Hickory Trees Threatened with Destruction.**—*Amer. Forestry, Washington, D.C.*, xxi, no. 259, July 1915, pp. 797–799, 3 figs.

Scolytus quadrispinosus (hickory bark borer) is responsible for the destruction of thousands of hickory trees all over Long Island and for hundreds of miles north and north-west of New York City. The only effective control is to burn the infested part of the tree or the whole tree during winter, while the larva is working underneath the bark. The hickory trees in Prospect Park, Brooklyn, have been saved in this manner, every other method having failed.

Surface (H. A.). **Habits of the Red Leaf Beetle.**—*Zool. Press Bull., Penns. Dept. Agric., Harrisburg*, no. 323, July 1915.

Galerucella cavicollis proved very destructive in 1914 in Pennsylvania and is now increasing and spreading to an alarming extent. It attacks the leaves of plants by eating away the underside, and sometimes making holes in the leaves. The foliage of cultivated sour-cherry trees suffers most, considerable damage being also done to the leaves of peach, pear and apple, while tomatoes and a few other plants are also attacked. Spraying with a solution of 1 oz. lead arsenate in 1 U.S. gal. of water is entirely effective. Investigations show that this species, unlike the elm leaf beetle (*G. luteola*), lays its eggs on or near the surface of the ground, especially where the soil is moist. The larvae bore down through the soil, and feed on the roots of the tree of which the beetles attack the foliage. The ground under infested trees should be well hoed twice weekly for two or three weeks in order to control the larvae.

Wilson (H. F.). **Miscellaneous Aphid Notes, chiefly from Oregon.**—*Trans. American Entom. Soc., Philadelphia*, xli, no. 2, June 1915. pp. 85–108, plates 5–11.

The life-cycle of *Prociphilus fraxini-dipetalae* in Oregon is passed on *Fraxinus oregona* and probably on *Pseudotsuga taxifolia* as an intermediate host. In spring, the Aphid appears on the leaves of the ash, causing a gall-like formation. Inside the curled leaves the stem-mothers produce forms which become alate and disappear from the ash about the first week in June. These forms are thought to go to the roots of Douglas fir and there produce the first of a series of summer generations of apterous females. In the autumn some of the Aphids present on the roots migrate to the ash and give rise to sexual forms. Those remaining continue to feed and can be found in all stages throughout the year. The females, after pairing, produce a single egg, in which stage the winter is passed on the ash. *P. bumeliae* on red and white ash has been imported into Oregon. This species feeds on the tips of the shoots, not on the leaves, as does *P. fraxini-dipetalae*. Several species are found on *Artemisia* (sage). *Chaitophorus tridentatae* occurs round the base of the leaf and flower stems. *Microsiphum canadense*, *M. artemisiae*, *M. oregonense*, *Aphis reticulata*, *A. oregonensis*, and *A. hermistonii* have been recorded. *Aphis tridentatae* was found together with *M. artemisiae* and *C. tridentatae* during May and June. *Macrosiphum artemisicola* occurred on *Artemisia vulgaris*. *M. artemisiae* was found in all parts of Oregon where *A. tridentata* was grown. A detailed description of the above species is given. The following new species are described: *Amphorophora subterrans*, collected on roots of *Dactylis glomerata*; *Macrosiphum mentzeliae*, found on *Mentzelia*; *Aphis lithospermi*, common on *Lithospermum pilosum* during June and July; *Macrosiphum pteridis*, found throughout western Oregon on *Pteris aquilina*; *Lachnus laricifoliae* and *L. oregonensis* on *Larix occidentalis* and the cones of *Pinus* sp. respectively; and *L. parvus*, occurring in rows along the needles of *Pinus virginiana* and *P. rigida*.

WEISS (H. B.). **Notes on the Occurrence of Some Economic Insects not Hitherto Recorded from New Jersey.**—*Psyche, Boston*, xxii, no. 3, June 1915, pp. 105–106.

The occurrence is noted of the following economic insects:—*Gracilaria zachrysa*, Meyr. (*azaleae*, Busck), in greenhouses; the saw-fly leaf-miner, *Kaliosysphinga ulmi*, Sund., on elms; *Coleophora limosipenella*, Dup., on elms; the leaf-miner, *Monarthropalpus buxi*, Lab., on box; *Leucaspis bambusae*, Kuw., on bamboo; and the larvae of *Merodon equestris*, L., in narcissus bulbs.

SENSTIUS (M. W.). **Observations on a Recent Invasion of Insects in the Coffee Nurseries in Java.** —*Mthly. Bull. Agric. Intell. & Plant Dis., Rome*, vi, no. 7, July 1915, p. 1006. [Abstract from *Mededeelingen van het Proefstation Malang, Soerabaya*, no. 7, December 1914, pp. 5–19, 3 figs.]

Each year since 1910, young coffee plants whose roots appeared to be attacked by borers have been received in August at the Malang Experiment Station. Sometimes the bark was also destroyed at some distance from the ground. Generally the young plants attacked in this manner died, whilst older ones were almost always checked in growth. Young plants of Quillon, Excelsa and Liberian coffee, as well as tea, are attacked in this manner. In the soil near the damaged plants were found the larvae of *Opatrum depressum* to the number of about 250 per square yard. These larvae cause damage to the plants, but it has not yet been determined if the adult beetles are also injurious. Numerous Tipulid larvae were also found in the coffee nurseries, but whether they attack coffee roots is not yet known. Trapping the larvae with pieces of potato is recommended, also spraying the soil before sowing with carbolineum of a strength of 1 in 250, or 1 in 500 after sowing.

Per sapere se lo zolfo è puro. [How to ascertain the purity of sulphur.] —*Venezia Agricola, Venice*, xviii, no. 27, 4th July 1915, p. 2.

Simple tests of the purity of sulphur may be made as follows:—When a small quantity of sulphur is burnt on a plate, there will be no residue if it is pure. If a pinch of sulphur is placed in a test tube containing carbon bisulphide no residue will be present if the sulphur is pure. A still simpler method is to try to make a paste of sulphur and water; pure sulphur will not form a paste.

Per riconoscere se il solfato di rame è adulterato. [How to ascertain whether sulphate of copper in adulterated.]—*Venezia Agricola, Venice*, xviii, no. 27, 4th July 1915, p. 2.

The addition of iron sulphate is the most common form of adulteration of copper sulphate. The presence of this substance may be detected by dissolving a small quantity of the copper sulphate in water and then adding a few drops of ammonia to the solution. A flocculent, brown precipitate indicates the presence of iron sulphate.

Martelli (G.). **Su due insetti nemici della Bianca-Rossa. Il Rizobio lofanta e l'Afelino del Crisomfalo.** [Two insect enemies of *Chrysomphalus dictyospermi* var. *pinnulifera*. Mask.: *Rhizobius lophantae* and *Aphelinus chrysomphali*.]—*Giorn. Agric. Merid., Messina*, viii, no. 6, June 1915, pp. 81–88, 4 figs.

In the natural control of the Coccid, *Chrysomphalus dictyospermi* var. *pinnulifera*, Mask., the Coccinellid, *Rhizobius lophantae*, Blaisd., is far more efficient than the Chalcid, *Aphelinus chrysomphali*, Merc., the ratio of efficiency being as 3 to 1.

Hinds (W. E.). **Chain drag for Boll weevil Control.**—*Alabama Agric. Expt. Sta., Auburn.* Press Bull. no. 78, 15th June 1915, 1 fig.

An exceedingly simple and inexpensive mechanical device for weevil control, the value of which has been proved in Texas, is the chain drag or cultivator. It does not catch the weevils or collect cotton squares, but combines in one process the cultivation of the crop and the collection of fallen, infested squares to the middle of the rows of the cotton, by drawing over the ground heavy chains attached to the ends of a beam so that they will assume a semi-circular shape when dragged along. Thus the infested squares are exposed to the heat of the sun and the weevils in various stages are killed. The device is of special value in hot, dry weather and on soils that are not baked. It is constructed as follows :—A spar or log of wood 2 or 3 inches in diameter and fairly heavy, 6 or 8 inches shorter than the distance between the rows of cotton plants, is taken, and to the ends of this, two pieces of chain, one shorter than the other, are attached so as to form two loops one inside the other. From 12 to 15 feet will be sufficient for the two loops, for a log 3 or 4 feet in length, and the best type is a square-linked chain such as is used in logging. By dragging the log and attached chains for a short distance over a smooth floor, the loops will arrange themselves more or less symmetrically. A wire is then attached to the middle link of each chain, and two more to the log at about one-third of its length from each end ; these wires are gathered up to and twisted round a piece of wood which will serve as a handle. The wires should be of such a length that the man in charge of the drag can conveniently lift the chains over stones or other obstacles or use them for guiding the drag. All that is needed further is to attach a draw-bar to the log by two chains of such a length so that the horse, when pulling on it, will not lift the log off the ground. In dry weather weevil infested fields should be gone over twice a week with this device. A man and mule can cover 7 or 8 acres a day. When used in dry weather, it will save the extra labour of handpicking infested squares as the sun will destroy the insects.

Bodkin (G. E.). **Report of the Economic Biologist.**—*Rept. Dept. Science & Agric., British Guiana, 1913–1914, Georgetown, Demerara*, 30th April 1914, 11 pp. [Received 24th July 1915.]

Considerable attention was paid to pests of the sugar-cane, especially to *Diatraea saccharalis* (small moth-borer). The life-histories and habits of a number of parasites of this pest were investigated. The

planting of tops infested with *Diatraea* seemed to be largely responsible for the appearance of this insect in newly planted areas and the continued infestation in older ones. Termites were reduced in numbers in many areas. *Castnia licus* (giant moth-borer) appeared to be increasing on some estates. The collection of unparasitised egg-masses of *Diatraea* was begun on some estates which had previously neglected this operation and a small number of egg-parasites were distributed. The rice crop was successful and no complaints were received of insect pests. Rubber continued to be unaffected to any extent by insects. The larva of *Castnia daedalus* attacked coconuts over a considerable area. A Plant Protection Ordinance is necessary to deal with this insect and also with *Brassolis sophorae*, which was abundant on coconut palms near Georgetown. The adults of *Strategus aloeus*, L., were troublesome on young trees and the presence of *Aspidiotus destructor* in some localities was due to poor drainage and consequent low vitality of the trees. Among the pests of cacao and coffee, the coffee leaf-miner occurred in numbers in some districts. Numerous seeds of *Elaeis guineensis* (West African oil palm) failed to germinate on account of infestation by the Bruchid, *Pachymerus* (*Caryoborus*) *nucleorum*, F. The eggs are deposited in one of the germinating holes which traverse the hard covering of the seed, after the latter has fallen to the ground. The larva passes to the interior of the seed and there feeds; when mature, pupation takes place within the seed. The adult emerges through a hole formed by the jaws in the side of the seed coat. About 70 per cent. of the seeds gathered beneath the palms were infested. Lists of insects attacking sugar-cane, rice, coconut, etc., and some of their parasites, are given [see this *Review*, Ser. A, i, p. 521, ii, pp. 57, 416, 520, 568].

BALABANOV. **Гдѣ зимуетъ яблоневый цвѣтоѣдъ.** [Where does *Anthonomus pomorum* winter].—**«Садоводъ.»** [*Horticulturist*], *Rostov-on-Don*, no. 6, June 1915, pp. 454–456. Reprinted from **«Сельск. Хоз.»** [*Agriculturist*, no. 17].

The author refers to the statement of N. Sacharov that *Anthonomus pomorum* winters in the forests, situated near orchards, which would account for the failure, in many cases, of remedies against this pest, such as sticky belts or washing the trunks of apple trees with lime.

GUDKOV (P.). **Вліяніе утилизаціи остатковъ червивыхъ плодовъ на распространеніе плодожорки.** [The influence of the method of utilisation of the wormy fruit on the spread of *Cydia pomonella*.]—**«Туркестанское Сельское Хозяйство»** [*Agriculture of Turkestan*], *Tashkent*, no. 5, May 1915, pp. 484–491.

Great damage is done by *Cydia pomonella* in Turkestan, where three generations of it occur and where the method of bag treatment is rendered more expensive and troublesome owing to the great height to which the local trees grow. The method of utilising the infested and fallen fruits, facilitates the breeding and spread of the pest and greatly aggravates the situation. In the Crimea, the rejected fruits are usually exported outside the horticultural region into the

steppes, villages, etc., thus also removing many caterpillars, which perish in the steppes. In Turkestan, no such export of waste fruit occurs, nor is it possible, as such fruit is preserved by drying, during which process the caterpillars escape. In order to remedy this state of things, the utilisation of infested fruit as food for cattle, or destruction of the caterpillars in it by fumigating with sulphur or soaking in water, is recommended.

JAKUBOVSKY (V.). **О лѣченіи гнильца.** [On the cure of foulbrood.] —**«Русскій Пчеловодный Листокъ.»** [*Russian Beekeeping Gazette*], *Moscow*, xxx, no. 5, May 1915, pp. 170–172.

The author criticises the method of curing foul brood recommended by R. G. Semenov [see this *Review*, Ser. A, iii, p. 38]. Experiments have shown that the division of the hive as proposed by him, is not advisable, as it tends to decrease the general strength of the colony and entails insufficient care of the brood by the remaining bees. The queen bee may, however, be isolated for 21 days, as experiments have shown that a queen-bee isolated for even more than two months, does not lose her fertility.

VASSILIEV (Eug. M.). **Еще о ловлѣ вредителей свеклы на бродящую патоку.** [More on the catching of pests on fermenting molasses.] —**«Вѣстникъ Сахарной Промышленности.»** [*Herald of the Sugar Industry*], *Kiev*, xvi, no. 22, 13th June 1915, p. 511.

This communication from the Entomological Branch of the Myco-Entomological Station of the All Russian Society of Sugar-refiners, reports that between 31st May and 4th June, 1915, adults of *Euxoa* and *Barathra* and also of *Bibio hortulanus*, L., were caught in fermenting molasses in beet plantations and vineyards near Smiela. This remedy is considered more effective than the adhesive paper recommended by German authors, and it can be applied, not only against Lepidoptera, but also against some Diptera, *Pegomyia hyoscyami*, Panz., being another pest, against which it has long been used by the Station.

CHOLODKOVSKY (N. A.). **Хермесы, вредящіе хвойнымъ деревьямъ.** [*Chermes* injurious to Conifers.] Published by the Department of Agriculture of the Central Board of Land Administration and Agriculture. Second, altered and enlarged edition. *Petrograd*, 1915, 89 pp., 6 figs., 7 plates.

In the introduction to this book, it is stated that the galls formed by species of *Chermes* were known and described much earlier than the insects themselves, the earliest reference to the former having been made in 1583 by a Dutch botanist, Clusius. It was only in the 18th century that Frisch discovered that insects live inside these galls. In 1887, Blochman discovered the males, while between 1887 and 1889, Dreyfus, Blochman and the author independently discovered the migrations of these insects.

The wintering stem-mother (fundatrix) of *Chermes viridis*, Ratz., may be observed early in spring where firs grow mixed with larches,

at the base of the buds, especially of the leading shoots. The stem-mother moults three times, after which it becomes mature and acquires an ovipositor, its full development lasting about a month. Near Petrograd, they are mature at the beginning of June. During oviposition, the stem-mother continues to suck the bud of the fir, producing an irritation, which deforms it and delays its growth. Before the last egg is laid, the first have already hatched and the resulting larvae creep between the scales and also suck the bud, thus furthering the production of the gall. About the middle of summer, the gall reaches the size of a hazel nut, or even of a walnut, its size depending upon the number of stem-mothers, which have contributed to its formation. Frequently the whole shoot is transformed into a gall, but in the majority of cases, the deformation affects only the base of the bud, so that a more or less lengthy shoot of normal structure emerges from the end of the gall. The larvae live during the summer inside the gall and moult three times. About the middle of summer (usually in the second half of July near Petrograd), the galls ripen and gradually burst open. At this time, the larvae, which have already passed into the nymphal stage, leave the gall, and moulting again on the same or the next day, become winged individuals. These soon leave the tree on which they have bred and settle on the needles of any larch trees in the neighbourhood, and deposit on them large heaps of dark green eggs. In two or three weeks, green larvae hatch from these eggs and remain over the winter in cracks, etc., of the bark. These winged individuals are called migrantes alatae, the larvae produced by them being called false stem-mothers (fundatrices spuriae) as distinguished from the real stem-mothers (fundatrices verae) which live on firs and produce the galls. The false stem-mothers become active in spring and attack the young buds of the larches. After moulting three times, they deposit a small heap of bright green eggs, from which larvae of a dirty green colour hatch in about two weeks. These give rise to the winged forms which were previously regarded as a separate species, *Chermes laricis*, Hartig. Near Petrograd, these appear on larches in the first half of June; they are called sexuparae, because, migrating back to fir trees, they deposit the eggs which produce a new sexual generation of both males and females (sexuales). Each sexupara lays about 10 greenish yellow eggs, mostly on old needles on the lower side of the branches; the sexuales hatch in about two weeks; after pairing, the males die, while the females penetrate underneath the scales of the bark, mostly near young shoots and each deposits one yellow egg. From this egg, the larva of the stem-mother, described above, hatches in August and September. Thus the whole cycle of this species lasts two years and contains five generations. As Dreyfus pointed out in 1889, the spring generation breeding on larches has two varieties, a green and a yellow one, and the recent observations of the author in Russia and Switzerland confirm the fact that some of the winged forms migrating to larches deposit on them yellowish green eggs, instead of dark green ones, which gradually become dark green in one or two weeks. The galls from which such winged forms arise, usually open later than those which produce the forms depositing dark green eggs, the process being delayed till the first half of August. The author proposes to call the green generation var. *viridescens* and the yellow one var. *lutescens*. A diagram of the life-cycle of this species is given.

Chermes abietis, Kalt., is a common insect in fir woods, even where no larch trees are present. The galls of this species are similar to those of *C. viridis*, but are of slightly smaller size; they open later near Petrograd, in the middle and second half of August. The opening galls produce pale yellow nymphs, which moult and produce winged forms; these remain on the needles of the same fir on which they have bred. They sometimes fly to some other fir trees. but do not migrate to larches or other conifers. They are called alatae non-migrantes and each of them deposits a large heap of eggs; in about two weeks the larvae of the stem-mother hatch and hibernate in cracks of the bark near the base of the buds; in the following spring the stem-mothers moult and oviposit, the eggs being yellow or yellowish green. Only these two stages exist (fundatrix and alatae non-migrantes) the cycle lasting one year and taking place on firs only. *C. viridis* and *C. abietis* closely resemble each other as regards their morphology, and this has led some authors to consider them as the same species. The author's observations have satisfied him, however, that this is not the case and that they must be regarded as separate species. At the same time, *C. abietis* can, and sometimes does migrate to and oviposit on larch, pine or silver fir, but the larvae from eggs laid on larches do not survive, nor do the larvae of the spring generation of *C. viridis* from eggs laid on firs instead of larches; the death of the larvae is due to the fact that the plants are unsuitable for their development; the proboscis of the fundatrices spuriae is too short to enable them to feed on firs, while those of the fundatrices verae are too long to attack larches.

The galls of *Chermes strobilobius*, Kalt., are frequently found in the same places and under the same conditions as those of *C. viridis*, but they are of smaller size and are found exclusively on the very ends of thin branches. The hibernating larval stem-mother lives on the bud itself, not at its base, as do those of the two previous species; it deposits over 100 eggs, though some of the larvae from these cannot find accommodation inside the galls and perish. This fact, i.e., the presence of larvae on the surface of the galls, is very characteristic both of this species and of *C. lapponicus*, Chol. The galls ripen quickly and open, in North Russia, in the second half of June or earlier; the nymphs issuing from the galls produce winged forms, which migrate to larches (migrantes alatae); there, each of them deposits on the needles about 20 yellowish red eggs from which greenish grey larvae hatch in about two weeks; these larvae winter in the cracks of the bark, appearing as false stem-mothers (fundatrices spuriae) and in the following spring they pass to the base of the buds, where they moult and oviposit. The great majority of the resulting eggs give rise to dark grey larvae, the skin of which has no glandular lamellae; these attack the young needles of the larches, turn blackish and moult three times, some of them passing into nymphs with rudimentary wings, while the others moult a fourth time and become clumsy, wingless brown forms, which oviposit on the larch needles and are called exules. The nymphs also moult again and produce winged sexuparae, which fly back to firs. According to Dreyfus and Börner, a small number of the eggs laid by the stem-mother produce larvae the skin of which has the same structure as that of the wintering larval false stem-mother; these do not develop

further during the summer, but creep into cracks of the bark and remain there until they moult next spring and become false stem-mothers. The sexuparae and exules were previously mistaken for separate species: *C. laricis*, Ratz., and *C. haemadryas*, Koch. The sexuparae fly back to fir trees, where they deposit from 5 to 10 eggs on the lower side of old branches; the eggs are of two kinds: yellowish green eggs, which produce male larvae in about two weeks, and reddish eggs, which give rise to the female larvae. The females lay fertilised eggs underneath the scales of the bark, from which the wintering stem-mothers arise at the end of summer or in autumn. The exules oviposit and produce larvae the structure of the skin of which is similar to that of the hibernating larvae of false stem-mothers, and these suck the needles of larches; according to Börner, the descendants of the exules are divided into hiemales and aestivales, but the author has only found those corresponding with hiemales; these larvae form a second generation of exules. It has not been established how many generations of them occur during one summer, their number evidently depending upon the weather and temperature, but in any case it is not less than two. The larvae from eggs laid by the last generation of exules during the summer, hibernate and appear in spring as false stem-mothers, their descendants being again divided into sexuparae and exules. It is supposed that the exules compensate for the wastage caused during the migration back to firs, when many sexuparae perish. It is not known how long the multiplication of exules can go on without the introduction of forms produced by new winged migrants from galls, but apparently it has no fixed limits. Generally speaking, in the absence of such new introductions, the number of sexuparae decreases and only exules remain eventually. The cycle of this species is possibly still more complicated and it may form both early and late variations. The author has sometimes found in July, when the normal migration of the winged forms has ended, oviparous winged forms on the bark of larches, which, in contrast to the winged migrants of June, covered their eggs with white down; the larvae from such eggs were somewhat different from the usual fundatrix spuria. The author calls this late variety *C. strobilobius* var. *tardoides*, but further researches are required to show whether this variety is connected with the cycle of development of *C. strobilobius*, or whether it is independent and constitutes a self-contained cycle.

Chermes lapponicus, Chol., stands in the same relation to *C. strobilobius*, as *C. abietis* does to *C. viridis*. It forms exactly the same galls, but has no migrations to larches and its multiplication is exclusively parthenogenetic; it is accordingly widely spread in the fir woods of North Europe, where no larches are present; it has only two stages a year (stem-mothers and winged forms) and a one yearly cycle. The galls ripen twice yearly, some opening in June, others in August; this gave rise to the assumption that two gall-producing generations occurred, the second of which was derived from eggs laid by the winged forms of the first one. Further investigations have shown that this is not a question of two generations, but of two varieties; an early one, *C. lapponicus* var. *praecox*, Chol., and a late one *C. lapponicus* var. *tardus*, Dreyfus. The var. *praecox* especially resembles *C. strobilobius*, though radically differing in its life-cycle;

it has been found only in Russia. The var. *tardus* occurs in Russia and Western Europe.

Chermes viridanus, Chol., was found by the author in 1895 in Estland (Russia), and later in Switzerland and other European countries. It lives only on larches, without migrating to any other kind of tree. Its life-cycle is incompletely known, the origin of the spring larvae not having been directly traced; they are found on young shoots of larch trees after May. They give rise to winged forms, which do not appear in North Russia before the end of June. They deposit eggs on larch needles, which produce wintering larvae in two or three weeks, the further development being unknown. As shown by Börner, they are not identical with the spring larvae, and probably they hibernate in the cracks of the bark, moulting in spring and becoming wingless oviparous forms, corresponding to the stem-mothers from the eggs of which the spring larvae hatch. If this is the case, the cycle of this species is a two-yearly one.

Small larvae of *Chermes viridulus*, Chol., were found by the author in 1910 underneath the scales of the bark of *Larix sibirica* in Estland. Wingless, oviparous forms were found at the same time which perished in the first half of July, while the larvae remained sucking the bark till the first half of September. It is thought that they hibernate and that next spring they produce wingless oviparous forms, this species having thus only wingless stages. They were at first thought to be the unknown stem-mothers of *C. viridanus*, but they differed from the wintering larvae of the latter both morphologically and biologically.

Chermes pectinatae, Chol., was first discovered by the author in 1887 near Petrograd and has hitherto only been found in Russia. The author's species, *C. coccineus*, is now considered a synonym of this. The hibernating larval stem-mother of this species oviposits on the fir bud, after having moulted three times; the galls of this species always cause a deformation of the whole bud and never have, at their tip, a continuation of the shoot. The nymphs from the galls transform into winged forms, which migrate to various species of silver fir, such as *Abies sibirica*, *A. balsamea*, etc., where they deposit on the lower side of the needles a large heap of reddish yellow eggs; from these the wintering larvae of the false stem-mothers arise, and these, having hibernated and moulted three times, lay dark yellow eggs, from which dark grey larvae hatch in two or three weeks and pass on to the young needles of silver fir. The larvae live on the needles, moult four times, according to Marchal, and divide into two varieties. Some, which are of a reddish violet colour, are only slightly covered with a white efflorescence, without waxy hairs, and become nymphs with rudimentary wings. The others, which are of a dark violet colour, with six lines of thick bundles of white hairs, become wingless oviparous exules. The nymphs, having moulted, again give rise to sexuparae, which appear in North Russia about the middle of June, and migrate to firs, where they oviposit on the needles of young shoots; in two or three weeks the larvae of the sexuales hatch and become, in about a month, adult males and females; after pairing, the females produce one egg, from which the larval stem-mother appears in the second half of August and hibernates on the buds of firs. The exules multiply on the needles in the same way as those of

C. strobilobius, the larvae from their eggs having a structure of the skin similar to that of the larval false stem-mother. Thus the cycle of this species is similar to that of *C. strobilobius*, though the intermediate plant is not the larch, but the silver fir, and it is probable that some of the eggs of the false stem-mothers produce larvae, which remain over the winter, although the author has not been able to observe them.

Chermes funitectus, Dreyfus, was first found in 1888 in Germany on *Tsuga canadensis* and the author gives P. Marchal's description of it (Contribution a l'etude de la biologie des *Chermes*. Annales des Sciences Naturelles, 9 serie, Zoologie, vol. 18, 1913) [see also this *Review*, Ser. A, vol. iii, p. 344].

Chermes piceae, Ratz., is found in Western Europe on the bark of trunks and branches of *Abies pectinata*; it is not found in Russia, this species of silver fir growing only in Poland. According to Marchal, it has no migrations, multiplies parthenogenetically and lives only on *Abies pectinata* (European silver fir). In 1901, Prof. E. Bouvier sent to the author examples of peculiarly injured *Abies nobilis* var. *glauca* (American silver fir) from the neighbourhood of Paris. This injury appears to have been due to the presence of *C. piceae* var. *bouvieri*, Chol., which differs from the typical form in not sucking directly on the bark, but forms galls on it and on the young shoots.

Chermes sibiricus, Chol., was discovered by the author in 1889 near Petrograd and has since been found in Switzerland. The wintering larval stem-mother usually occurs at the base of the needle of fir trees, near the bud at the end of the branches or on the bark of a shoot of the previous year, not far from the bud. Owing to the fact that they do not suck the bud itself, but the bark at some distance from it, their influence on the formation of the shoots differs from that of other species of *Chermes*. The shoot is usually shortened and thickened and the thickened bases of the needles on one side of it grow together. The larvae appear in the first half of June as nymphs, with rudimentary wings; the galls usually open earlier than those of any other *Chermes*. The nymphs moult and become winged and fly from the fir trees to *Pinus cembra* (Siberian cedar) on the needles of which they oviposit. The larval false stem-mothers appear in two or three weeks, pass on to the bark of cedars and remain there over the winter; next spring they moult and appear as wingless forms of varying colour. They deposit yellow eggs, giving rise to individuals which pass on to the green bark of the young shoots and split into exules and nymphs, which become sexuparae after moulting. The exules continue to develop on the bark of cedars, while the sexuparae return to firs and oviposit on them, producing sexuales. The females deposit one egg each, which produces the wintering larval stem-mother. Thus the life-cycle of *C. sibiricus* resembles that of *C. strobilobius*, but for the intermediate plant, which is not larch but cedar.

Chermes pini, Koch, and *C. orientalis*, Dreyfus, constitute one species, divided into two biological varieties, a northern one, *C. pini* var. *pinicola*, which has only a rudimentary migration to firs, multiplies almost exclusively by parthenogenesis and very rarely produces galls, though it gives rise to a large number of winged exules; and a southern one, *Ch. pini* var. *orientalis*, Dreyfus, which has a complete cycle, forming galls on Caucasian firs (*Picea orientalis*), not on European fir (*Picea excelsa*), and producing, on pines only, a small number of winged exules.

Chermes strobi, Hartig., is frequently found on the bark of trunks and branches of *Pinus strobus*; the stem-mothers and galls of this species are not known and the author is of opinion that it cannot complete its full cycle of development in Europe.

Besides the above species which occur in Europe and Russia, exotic species are also dealt with. *C. abietis-piceae* (*C. himalayensis*, Stebbing), is regarded as a distinct species, near to *C.* (*Aphrasthasia*) *pectinatae*, Cholod. With regard to *C. cooleyi*, Gillette, *C. montana*, Gillette, *C. similis*, Gillette, *C. coloradensis*, Gillette, *C. pinifoliae*, Fitch, *C. abietis*, Kalt., *C. lariciatus*, Patch, *C. consolidatus*, Patch, *C. floccus*, Patch, *C. similis*, Gillette, and *C. pinicorticis*, Fitch, only *C. cooleyi*, *C. floccus*, and *C. lariciatus* can be regarded at present as well-established, distinct species.

All the described European species of *Chermes* can be divided biologically into three groups: (1) Those breeding on firs and larches, or only on firs or only on larches, viz:—*C. viridis* and *C. abietis*; *C. viridanus* and *C. viridulus*; *C. strobilobius* and *C. lapponicus*; (2) those breeding on firs and silver firs or only on silver firs, viz:—*C. pectinatae*, *C. funitectus* and *C. piceae*; and (3) those breeding on firs and on trees of the genus *Pinus*, or only on firs, or only on pines (*C. sibiricus*, *C. strobi*, *C. pini* and *C. piniodes*). Thus fir trees connect in some way the different groups, but some of the species have freed themselves from this connection and breed only on intermediate trees, e.g. *C. piceae*, *C. viridanus* and *C. viridulus*, while others have dispensed with migrations and occur only on firs. The origin and importance of migrations is discussed, and the author still holds to the hypothesis he proposed in 1896, that the ancestral forms of *Chermes* lived only on trees of the genus *Picea* and only on the bark, where they produced sexual forms at the end of summer; this yearly cycle gave way to a two-yearly one, when, through some agency or other, such as wind, the winged individuals were transported to other trees, and, in mixed forests, to trees of some other genus; in such forests the descendants of these emigrants have had to adapt themselves to breeding on new trees, though the following year the same causes may have brought the sexuparae of these forms back to firs, where they gave birth to a sexual generation. If the occurrence of sexual forms even of a single species of *Chermes* on any other trees than firs should be discovered, the author's theory will have to be revised.

Enemies of *Chermes* include CHALCIDIDAE, although the author himself has never discovered them attacking *Chermes*; Syrphid and other Dipterous larvae, such as those of *Agromyza chermivora*, Kalt.; Coccinellid larvae, especially of the genus *Scymnus*; larvae of *Anthocoris*, various Acarids, etc. The larvae of some TENTHREDINIDAE and Lepidopterous caterpillars are casual enemies, which devour individual *Chermes* together with the needles of Conifers.

The damage done by *Chermes* consists of (1) the formation of galls, followed by total destruction or deformation of the shoots, the most injurious in this respect being those species which have no migration and breed from year to year on the same trees; (2) the sucking of the bark, which is however less important, although *C. piceae* var. *bouvieri* and *C. funitectus* are very injurious in this respect, the latter chiefly to young trees; and (3) sucking of the needles, which is also of no great importance, except in the case of *C. funitectus*. The

destruction of young galls and of infested shoots is only practicable on a small scale. The stem-mothers, which are easily detected on the ends of fir branches in spring, may be destroyed with a rough brush, preferably moistened with turpentine or kerosene emulsion. Spraying with a mixture of four parts of tobacco-extract and two or three parts of green soap (prepared by dissolving 5 lb. of soap in about 3 gallons of water) and adding 10 parts of water, may be tried. Another spray consists of 3 lb. of green soap dissolved in about 2 gallons of water; this is boiled and ¾ pint of liquid paraffin is added, and stirred; before use it is dissolved in about 5½ gallons of water. Fumigating with hydrocyanic acid, as used in America against *Aspidiotus perniciosus*, is also recommended. A key to the subgenera of *Chermes* and another to the European species, and seven coloured plates are included in this elaborate and valuable work.

Ossipov (K.). **Зимняя пяденица въ Бессарабіи въ 1914 г. и мѣры борьбы съ ней.** [*Cheimatobia brumata*, L., in Bessarabia in 1914 and its control.] **« Плодоводство.»** [*Fruit-Growing*], *Petrograd*, no. 5, May 1915, pp. 321–327.

Cheimatobia brumata, L., did great damage in orchards in Bessarabia in 1914. Good results were obtained in one village, where spraying operations were started in the spring, the insecticide used being Paris green in the following combination: 12 oz. of green, 12 oz. of quick lime, and 5 lb. of green soap in about 55 gallons of water. This remedy also gave good results in the other districts except where its effect was interfered with by rain. In the majority of orchards no remedies were applied and they were totally defoliated and produced no crop. The local Entomological Station recommends applying tanglefoot bands in autumn.

A. F. **Къ предстоящему энтомологическому совѣщанію въ Тифлисѣ.** [On the coming Entomological Conference in Tiflis.] —**« Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd*, no. 21, 5th June 1915, pp. 599–600.

The objects of the Conference in Tiflis, which was to take place on 12th June, included the question of the establishment of Entomological Organisations in Transcaucasia. According to a report prepared by B. P. Uvarov, the formation of three Bureaus was proposed:—One at Baku, to serve the governments of Elisavetpol and Baku and the province of Daghestan; one at Tiflis for the government of Tiflis, Erivan, the province of Kars and the district of Zakatali; and the third at Kutais, for the government of the same name and the province of Batum. It is estimated that the expenses of the Bureau in Tiflis will amount to about £3,000 per annum.

Rostovtzev (A.). **Пицундская сосновая роща, какъ памятникъ природы.** [The Pitzunda pine forest (govt. of Kutais) as a monument of Nature.]—**« Лѣсной Журналъ.»** [*Forestry Journal*], *Petrograd*, xlv, no. 1–2, 1915, pp. 45–104, 4 figs., 1 map.

The Pitzunda virgin pine woods are situated on the Cape of the same name in the district of Suchum, government of Kutais, the total area being about 445 acres covered with *Pinus pithyusa*, Strang. A great

deal of damage to the trees is done by various HYLESINAE, mostly *Myelophilus piniperda* and *M. minor*, the number of damaged trees being 645 in 1911, 615 in 1912, and 194 in 1913. The figure for 1911 is equivalent to about 40 trees on every 27 acres. Removal of the injured trees is the only remedy applied, but the author advocates the use of trap trees in addition.

VITKOVSKY (N.). **I. Отчетъ о дѣятельности въ 1914 году энтомологическаго подотдѣла Губернской Управы. II. Обзоръ вредителей сельскаго хозяйства, наблюдавшихся въ 1914 году.** [I. Report on the work of the Entomological Subsection of the Uprava (of the Zemstvo) of the government of Ekaterinoslav in 1914. II. Review of the pests of Agriculture noticed in 1914.] Published by the Zemstvo of the govt. of Ekaterinoslav, *Ekaterinoslav*, 1915, 68 pp.

The second of these papers deals with the pests recorded in Ekaterinoslav during the year under review. Pests of cultivated field crops included *Oria* (*Tapinostola*) *musculosa*, Hbn., which is the chief enemy of both summer and winter sown crops. In 1915, this insect again spread to the east of the river Dnieper [see this *Review*, Ser. A, iii, pp. 4 and 110] and did an enormous amount of damage. The caterpillars were largely parasitised by *Bracon abscissor*, Nees, and related species and were infested with an unidentified disease. The four stages of injury caused by the caterpillars are described. The first stage may be observed in the middle of April and consists in the fading and withering of the main shoots of the young corn resembling the injuries caused by *Oscinella* (*Oscinis*) *frit*, but differing in that the destruction of the plants proceeds more rapidly owing to the fact that the caterpillars of *O. musculosa* are able to pass from one plant to another. The second stage consists in injury to the stems, the caterpillars penetrating into the lower part and causing the upper part to turn yellow; this takes place in the middle of May. The third stage involves injury to the ears, when the latter, though fully developed, are still in the sheaths, the caterpillars entering through a hole at the bottom of the sheath and devouring the ear from the sides and top. The last stage, not previously described, occurs when the ears have emerged from the sheath, but owing to the stalks being gnawed through, the grain cannot mature; here apparently the caterpillars feed for the last time before pupating. This form of injury resembles that caused by *Cephus pygmaeus* and *Chlorops taeniopus*, Meig. [see this *Review*, Ser. A, iii, p. 110.] The pupae were first found on 26th June, their number being small in comparison with the number of caterpillars, owing to the presence of parasites and disease. The Ichneumonid, *Anomalon latro*, Schr., and another species were reared from the pupae, about 6 per cent. being infested. In captivity the females oviposited on summer wheat, barley and oats. Of the weeds examined, eggs were mostly found on *Agropyrum* (couch grass), seldom on *Setaria*, except when this weed was specially abundant. *Euxoa* (*Agrotis*) *segetum*, Schiff., also occurred in serious numbers during the year. *Pyrausta nubilalis*, Hbn., was everywhere injurious to maize, the crops in some localities being totally destroyed. *Trachea* (*Hadena*) *basilinea*, L., is widespread, but does not cause appreciable

damage. *Phlyctaenodes* (*Eurycreon*) *sticticalis*, L., was reported only from one locality of the district of Mariupol, where the caterpillars injured maize.

Coleopterous pests included:—*Anisoplia austriaca*, Herbst, present everywhere in enormous numbers; larvae of *Agriotes lineatus*, L., and *Athous niger*, L., injuring crops in some districts; *Pentodon idiota*, Herbst, injuring maize; *Bothynoderes* (*Cleonus*) *punctiventris*, Germ., attacking sugar-beet in some districts; *Otiorrhynchus ligustici*, L., *Psalidium maxillosum*, F., *Calandra granaria*, L., *Bruchus pisorum*, L., (*pisi*, L.), *Tenebroides* (*Trogosita*) *mauritanica*, L., *Ophonus calceatus*, Duft., *Zabrus blaptoides*, Creutz., *Cassida nebulosa*, L.; *Podonta nigrita*, F., on ears of wheat; *Chaetocnema* (*Plectroscelis*) *breviuscula*, Fald., and *Haltica euphorbiae*, F.

Dipterous pests were:—*Mayetiola destructor*, Say; *Chlorops taeniopus*, Meig., very widespread and mostly injuring barley; from the puparia some parasites of the Braconid genus *Dacnusa* were reared; *Oscinella frit*, L. Among the Hymenoptera, *Cephus* sp. was numerous in some districts, but greatly infested with Chalcid and other parasites. Aphids were very numerous and attacked practically all field crops, the following species being reported:—*Macrosiphum granarium*, Kirby; *Siphonophora cerealis*, Kalt., on leaves and ears of barley; *Pentaphis trivialis*, Pass., on roots of barley; *Toxoptera graminum*, Rond., on barley and oats. *Tetraneura rubra*, Licht., and *Capsus lineolatus*, Goeze, occurred on lucerne. Thrips injured wheat and oats in some localities, but only *Frankliniella* (*Haplothrips*) *tritici*, Kurdjumov, was identified. Orthoptera: *Locusta* (*Pachytylus*) *migratoria*, L., and *L. danica*, L., were observed, but were not present in serious numbers.

Pests of orchards and market gardens included:—*Hyponomeuta malinellus*, Zell., *H. variabilis*, Zell., *Cydia pomonella*, L., *Cydia* (*Grapholitha*) *funebrana*, Tr., *Lymantria dispar*, L., *Euproctis chrysorrhoea*, L., *Aporia crataegi*, L., *Malocosoma* (*Lasiocampa*) *neustria*, L., *Zeuzera pyrina*, L. (*aesculi*, L.), *Cheimatobia brumata*, L., *Pieris brassicae*, L., *Barathra* (*Mamestra*) *brassicae*, L. Coleoptera: *Epicometis hirta*, Pod., *Rhynchites giganteus*, Kryn., *R. auratus*, Scop. *R. pauxillus*, *R. bacchus*, L., *Byctiscus betulae*, L. (*R. betuleti*, F.), *Sciaphobus squalidus*, F., *Anthonomus pomorum*, L., and *Melolontha melolontha*, L. *Polyphylla fullo*, L., was noticed in large numbers and the larvae did considerable damage, though carbon bisulphide proved effective against them. *Lethrus apterus*, Laxm., injured vine shoots and vegetables; *Haltica erucae*, F. (*tamaricis*, Schr.), and *H. quercetorum*, Foudr., were very injurious to oaks in one locality, and *Phyllodecta* (*Phratora*) *vitellinae*, L., and *P. vulgatissima*, L., attacked black poplars, skeletonising the leaves. *Lytta vesicatoria*, L., in its imago stage, defoliated ash trees in one locality. Fruit trees were attacked by *Aphis pomi*, De Geer (*mali*, F.), *Hyalopterus arundinis*, F. (*pruni*, F.), the excreta of which caused an outbreak of *Capnodium salicinum*, Mont., and *Siphonophora rosae*. *Dolycoris* (*Pentatoma*) *baccarum*, L., was observed on raspberries, *Lepidosaphes ulmi*, L., on pears and apple trees, *Eulecanium pyri*, Schrank, on plums, *Eriocampoides limacina*, L. (*Selandria adumbrata*, Klug), on cherries and *Ardis* (*Selandria*) *bipunctata*, Klug, on roses. *Gryllotalpa gryllotalpa*, L.,

appeared in several localities, injuring cabbages, tomatoes and water melons. *Eriophyes* (*Phytoptus*) *pyri*, Pagenst., and *E. vitis*, L., were present. A map of the government showing the distribution of *Oria musculosa* in 1914 is appended.

Afanassiev (A. P.). **Русское виноградарство въ 1914 году (2-й вегетаціонный періодъ).** [Russian viticulture in 1914 (2nd vegetative period).]—**«Вѣстникъ Винодѣлія.»** [*Messenger of Viticulture*], *Odessa*, no. 5–6, May-June, 1915, pp. 219–251.

This is a further account of the general state of viticulture in Russia in 1914 [see this *Review*, Ser. A, iii, p. 477], being a summary of local correspondence from various places in 16 governments and provinces of South Russia and the Caucasus; the period dealt with comprises the second part of the summer up to the end of August. In Bessarabia: *Phylloxera* was common and *Polychrosis botrana* and *Clysia ambiguella* were also reported from some districts. Both the beetles and larvae of *Melolontha* have done great damage in Kishinev, and Kiev. No pests are mentioned in the reports from the governments of Podolia, Cherson and Ekaterinoslav. Some correspondents from one district of Taurida report an outbreak of a Curculionid (probably *Otiorrhynchus* sp.), and in another district damage was noticed from wasps; the remaining districts were practically free from pests, as were also the provinces of Don and Terek and the governments of Astrachan, Stavropol and Kutais. *Epicometis* (*Tropinota*) *hirta* and *Melolontha* were reported from one district of the province of Kuban, and *Ino ampelophaga* from the Black Sea. The following pests were reported in Tiflis: *Byctiscus betulae* (*Rhynchites betuleti*), *Polychrosis botrana*, *Dociostaurus* (*Stauronotus*) *maroccanus*, *Pseudococcus vitis*, against which two powderings with sulphur gave good results, and *Eriophyes* (*Phytoptus*) *vitis*, the spread of which was checked by spraying the lower side of the leaves with Bordeaux liquid. No pests are mentioned from the province of Daghestan or the government of Erivan.

Markov (M.). **Что удобнѣе?** [What is more convenient?]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-Growing & Market-Gardening*], *Petrograd*, no. 25, 4th July 1915, pp. 724–726.

The author compares the advantages of Paris green according to his practice and that of N. Balabanov [see this *Review*, Ser. A, iii, p. 21] with that of arsenic as recommended by S. Rogozin [see this *Review*, Ser. A, iii, p. 20] and states that Paris green dissolved in salammoniac is cheaper, more easily and readily handled and less dangerous than white arsenic. In his orchard in Simbirsk he has successfully applied the former, 1 lb. of Paris green being dissolved in about $1\frac{1}{2}$ lb. of salammoniac. For use, 2 tablespoonfuls of this solution are diluted with about 3 gallons of water, when applied in rainy weather, while in dry weather, the same amount is diluted with about $4\frac{1}{2}$ gallons of water.

Riabov (D.). **Очередное массовое появленіе зимней пяденицы.** [The next periodic outbreak of *Cheimatobia brumata.*] —« **Прогрессивное Садоводство и Огородничество.** [*Progressive Fruit-Growing & Market-Gardening*], *Petrograd*, no. 25, 4th July 1915, pp. 721–722.

The author refers to the regular periodicity in the occurrence of outbreaks of various pests, and is of opinion that a large outbreak of *Cheimatobia brumata* is due to take place in South Russia in 1916. The last great outbreak of this pest in the governments of Poltava and Charkov occurred in 1905 and 1906. Since then it has not appeared in great numbers, but signs of the impending outbreak were observed in the woods in the government of Charkov, many oaks, limes, pears, etc., having been totally defoliated.

Защита растеній отъ вредителей. [Protection of plants from pests], no. 1 (19). —Supplement to « **Любитель Природы.**» [*Friend of Nature*], *Petrograd*, 1914, 16 pp. [Received 21st August 1915.]

The following two articles relating to Entomology are contained in this number :—

Moritz L. **Изъ наблюденій надъ саранчей.** [Observations on locusts], pp. 1–7, 6 figs.

The chief breeding places of locusts in the province of Terek are situated on its eastern border, in the reeds along the Caspian Sea. In 1913 the hatching of *Locusta* (*Pachytylus*) *migratoria*, L., began on 20th May and continued till about the middle of June. The adults began to appear about the 28th June. The migrations proceeded from south-east to north-west, coinciding with the direction of the large growths of reeds. Frequently they also moved with the wind or in the direction of the sun. Oviposition began on 20th September, and in the first half of October the pest gradually disappeared. Enemies of locusts observed, include rooks (*Corvus frugilegus*), *Pastor roseus* and *Sturnus vulgaris*, eagles of the genus *Aquila* and also swamp tortoises (*Emys orbicularis*), which were seen to destroy the larvae passing across an irrigation channel. About 6 per cent. of the locusts were infested with larvae of a Tachinid fly and a mite of the genus *Trombidium* was also observed to parasitise them, usually at the base of the wings. Larvae of Cantharidae were frequently found in the egg-clusters devouring the eggs. The chemical method gave good results, especially sodium arsenite with zinc oxide, which caused death a day after the locusts had devoured it ; the effect of Paris green with lime was slower and was only noticeable after two days. The poison affected individuals of the first two stages more rapidly.

Plotnikov (V.). **Къ біологіи мартовскаго хруща.** [On the biology of *Melontha afflicta*, Ball], pp. 7–10, 2 figs.

Melolontha afflicta, Ball., and *M. clypeata*, Rott., which is found far less frequently, replace in Turkestan the European species *M. melolontha*, L., and *M. hippocastani*, F. The life-history of *M. afflicta* differs greatly from that of the European species and it

cannot be considered a very injurious insect like the latter or like *Polyphylla adspersa*, Motsch., with the larvae of which its own larvae are sometimes found. The adults of *M. afflicta* are on the wing in March and April during the short twilight, after which they hide in the earth; individuals on the wing are mostly males, the females only flying after oviposition is completed. This is effected in shady spots, underneath large trees, etc. Three stages of the larvae occur, the first one wintering and moulting in the following spring. The whole cycle of development lasts four years.

GINTZENBERG (A. A.). **Вишня и ея промышленная культура.** [The Cherry and its cultivation.] Supplement to the Journal.— **«Плодоводство.»** [*Fruit-Growing*], *Petrograd*, pt. 1, 1914, 108 pp., 48 figs.; pt. 2, 1915, 111 pp., 65 figs.

One chapter of this book deals with pests and diseases of cherry trees, an account of the life-histories and methods of control being given, with figures of the insects concerned.

Insects injurious to foliage include *Eriocampoides limacina*, L., (*Eriocampa adumbrata*, Klug), the females of which oviposit in June, and the larvae feed until about September, when they pass into the earth to hibernate. The females of *Neurotoma* (*Lyda*) *nemoralis*, L. (*punctata*, F.), deposit in spring some 30 or 40 eggs, in lines on the lower side of the leaves, the larvae living in colonies in webs and defoliating the trees. In June they pass into the earth and hibernate; in some years this pest does enormous damage. The larvae of *Priophorus padi*, L. (*Cladius albipes*, Fall.), skeletonise the leaves and enter the earth in June and hibernate. The remedies against all these three species consist of spraying with Paris green or Djipsin. The larvae of *Lyonetia clerkella*, L., also mine the leaves; there are two generations of this moth, the winter, according to some authors, being passed in the egg-stage or, according to others, as an imago. Spraying with Paris green is only effective at the moment when the larvae hatch; later, they are protected by having already entered the tissue of the leaf and can then only be crushed. Against *Myzus cerasi*, F., which, besides the direct injury caused, also assists the spread of *Capnodium salicinum*, the best remedies are spraying with quassia decoction, *Lignum quassi surinamensis* (*Lignum quassi rospatum*, the Java quassia, not being effective); tobacco decoction (8 to 12 oz. in about 3 gals. of water) with a mixture of 2 parts of green soap and 1 part of tobacco extract; California mixture; and the so called Dufour liquid, which is prepared as follows: $5\frac{1}{4}$ oz. of green soap are dissolved in two pints of hot water, about 2 oz. of fresh Persian powder being gradually added, and the whole then made up with water to 3 gals. The caterpillars of *Cheimatobia brumata*, L., devour the buds and later the leaves; sticky belts are advised in order to prevent the females from reaching the trees and ovipositing on them. When these have been removed and burned in late autumn, the trunks should be painted with a mixture of 2 parts of iron sulphate and 1 part of quicklime in about 3 gals. of water, so as to destroy the eggs, which the females may have deposited on them. Spraying with Paris green early in spring against the caterpillars, when the buds unfold, and repeating this when the leaves appear, is also recommended. *Tortrix cerasana*, Hb., the caterpillars of which injure buds and leaves, may be controlled by spraying with Paris green.

The following insects injure the fruit :—*Rhynchites auratus*, Scop., may be controlled by spraying with a solution of quicklime before the swelling of the buds, and with Paris green after flowering, and repeating this in 10 days. The destruction of the stones, removed when making jam, and of all fallen fruit, is advisable. *Anthonomus rectirostris*, L. (*druparum*, L.), attacks bird-cherries and peaches, as well as cherries. The females pierce the fruits with their proboscis and oviposit inside the stone, the larvae devouring the contents of the latter and pupating inside it. The same remedies as against *R. auratus* are recommended, besides planting bird-cherry trees in orchards as traps. *Rhynchites cupreus*, L., is widely spread in South Russia, Caucasia and along the lower Volga; the imago attacks the buds, leaves and flowers, and oviposits in wounds on the fruit, afterwards gnawing the pedicel and thus causing the fruit to drop. The larvae develop in five or six weeks and pupate in the earth, producing imagines in winter, which only emerge from the earth in the following spring. According to Schreiner, liming the trees before the flowering, shaking down the weevils and collecting and destroying fallen fruits three or four times during May and June are the best remedies. *Rhagoletis* (*Spilographa*) *cerasi*, L., appears in May and June, attacking *Lonicera xylosteum* and *L. tartaricum* (honeysuckle) and ovipositing inside cherries. These plants should therefore not be allowed near cherry orchards. Cultivation of the soil late in autumn and early in spring and collecting the cherries before the larvae have emerged, are advised. Poultry will also destroy the pupae of these flies.

Insects which injure the bark and trunk include :—*Scolytus rugulosus*, Ratz., for which the usual remedies are described. According to Mokrzecki, young trees should be smeared in June with carbolic emulsion, which penetrates through the pores of the bark and destroys the larvae. Wounds may be treated with tobacco-carbolic emulsion prepared as follows :—2 lb. of tobacco extract, 1 lb. of crude carbolic acid, 1 lb. of purified carbolic acid and 1 lb. of green soap are mixed in hot water and then made up to about 15 gals. with water ; to every 27 gallons of this mixture about 1 lb. of Paris green may be added, the mixture being then applied with a brush. Heavily infested trees should be made use of as trap trees and burnt when the larvae are observed in them. Popular information concerning insecticides, sprayers, methods of spraying, etc. is also given.

Gorianov (A.). **Къ біологіи озимой и восклицательной совокъ.** [On the biology of *Euxoa segetum*, Schiff., and *Feltia exclamationis*, L.] Reprint from **«Любитель Природы.»** [*Friend of Nature*], *Petrograd*, 1915, 7 pp.

Euxoa segetum, Schiff., and *Feltia exclamationis*, L., are usually found together. The numbers of these species caught in molasses troughs show that there is no regularity in their relative prevalence at a given season or in any one year, though *F. exclamationis* is always the more numerous in the aggregate. In the district of Riazhsk, government of Riazan, between the 2nd and the 24th July, 122 specimens of *F. exclamationis* and 18 of *E. segetum* were captured, while from that date until the 1st September, 293 of the latter and 33 of the former were taken. After the 24th July, the examples of *E. segetum* probably belonged to the second generation. In that case, this generation

appeared nearly a month earlier than is usual, which may have been due to the exceptionally hot summer. A similar early emergence of the second generation of *E. segetum* is usual in the government of Kiev. No second generation of *F. exclamationis* was observed. The females of this species largely outnumbered the males, the reverse being the case with *E. segetum*.

Ksenjopolsky (A. V.). **Обзоръ вредителей Волыни и отчетъ о дѣятельности Волынскаго Энтомологическаго Бюро за 1914 годъ.** [A review of the pests in Volhynia and report on the work of the Volhynia Entomological Bureau for 1914.] Published by the Zemstvo of the govt. of Volhynia, *Jitomir*, 1915, 53 pp.

In this report the various pests of Agriculture in Volhynia are dealt with. They include :—Lepidoptera : *Pyrausta* (*Botys*) *nubilalis*, Hb. ; *Tortrix viridana*, L. ; *Cydia* (*Grapholitha*) *funebrana*, Tr. ; *Simaethis pariana*, L., on apples ; *Homoeosoma nebulella*, Hb., which attacked sunflowers ; *Rhyacionia* (*Retinia*) *resinella*, L., which did great damage to conifers ; *Gracillaria syringella*, F., and *Malacosoma neustria*, L., against which spraying with lead arsenate was very effective. Coleoptera : *Anisoplia deserticola*, Fisch., *Psylliodes attenuata*, Koch, and *Phyllotreta cruciferae*, Goeze. Hymenoptera : *Athalia spinarum*, F., *Pteronus ribesii*, L. (*Nematus ventricosus*, Cl.), on gooseberries, *Eriocampoides* (*Eriocampa*) *annulipes*, Kl., *Hoplocampa testudinea*, Kl., on paradise apples, *H. fulvicornis*, Kl., on plums, *Lophyrus pini*, L., Diptera : *Chortophila* (*Anthomyia*) *funesta*, Kühn, damaging field crops, *C. brassicae*, Bouché, and *Hylemyia antiqua*, Mg. Rhynchota : *Psylla pyricola*, Först., *Psylla mali*, Först., *Chermes strobilobius*, Kalt., and *C. viridis*, Ratz., on firs, *Eulecanium pyri*, Schr., and *Lepidosaphes ulmi*, L., (*Mytilaspis pomorum*, Bouché), on pears, *Phorodon humuli*, Schr., *Siphonophora pisi*, Kalt., *Hyalopterus arundinis*, F., (*pruni*, F.), *Rhopalosiphum ribis*, Buckt., on plums (these Aphids being attacked by *Cantharis fusca*, L., and *C. obscura*, L.), *Myzus cerasi*, F., *Aphis pomi*, De Geer, *Aphis sorbi*, Kalt., *Aphis brassicae*, L., and *Siphonophora rosae*, L.

A separate list of insects attacking hops is given, including :—*Vanessa io*, L., *Pyrausta nubilalis*, Hb., *Melolontha melolontha*, L., *Otiorrhynchus ligustici*, L., *Agriotes segetis*, Bjer., *Haltica oleracea*, L., *Phyllotreta nemorum*, L., *Chaetocnema concinna*, Chevr., *Psylliodes attenuata*, Koch, *Gryllotalpa gryllotalpa*, L., *Phorodon humuli*, Schr., *Tetranychus telarius*, L., and the fungus *Capnodium salicinum*, Mont.

A general report of the work of the Bureau is appended. The budget for 1915 amounted to £380, of which half is provided by the Department of Agriculture and the other half by the Zemstvo.

Jachevsky (G.). **Питомники и фруктовые сады въ Окнинскомъ имѣніи Князя А. Е. Гагарина.** [Nurseries and orchards in the Okna estate (govt. of Cherson) of Prince A. E. Gagarin.]—**«Вѣстникъ Садоводства, Плодоводства и Огородничества.»** [*Messenger of Gardening, Fruit-growing & Market-gardening*, (organ of the Russian Imperial Horticultural Society)], *Petrograd*, no. 4, 1915, pp. 295–308.

The following insects are recorded :—*Lethrus* sp., *Lymantria* (*Ocneria*) *dispar*, *Malacosoma* (*Gastropacha*) *neustria*, *Euproctis*

(*Porthesia*) *chrysorrhoea* and *Aporia crataegi*, all of which appear in small numbers. Various Aphids were very numerous and the infested trees were treated with quassia decoction (5 lb. in 27 gallons of water). *Eriosoma lanigerum* was not present, evidently owing to the dry climate. In the orchards *Hyponomeuta malinellus*, *Cydia pomonella*, *Epicometis* (*Tropinota*) *hirta* and *Oxythyrea stictica*, occurred. The first two are controlled by spraying the trees immediately after blossoming, with Bordeaux liquid and Paris green (about 5 oz. of green in 55 gallons of the liquid). The collection and removal of fallen fruit was also carried out against *C. pomonella*. The two beetle pests are controlled by handpicking and shaking the insects from the trees and burning them.

POLOVNIKOV (P.). **Рожновъ боръ, Владимірской губерніи.** [The Rozhnov pine and fir forest, govt. of Vladimir.] — **« Лѣсной Журналъ.»** [*Forestry Journal*], *Petrograd*, xlv, no. 4, 1915, pp. 564–580.

The Rozhnov forests, which are the remains of the well known Murom forests, were not looked after in any way until 1848 and they suffered severely from fires, insect pests, etc. In 1850, after large fires in the preceding years, some 8,600 acres of the forest were attacked by a sawfly and then by Scolytid beetles. In 1861 *Bupalus piniarius*, L., was also observed in the forests, and in the late eighties, when some afforestation works had been undertaken, the soil of the empty spaces in the woods was for the first time reported to be infested with larvae of *Melolontha*, which destroyed all the new plantations. It was therefore decided to abstain altogether from replanting the empty spaces and to concentrate the afforestation work on fresh cuttings. In 1902, narrow cuttings not more than 105 feet wide from East to West were made, but proved useless. In order to study methods of controlling the larvae of *Melolontha*, the Forestry Department established an experimental forestry station, the author being appointed superintendent of it, which post he held for two years, and during this time much attention was paid to the biology of and damage done by this pest. In the Rozhnov forests, these insects do not oviposit either on old waste ground, even when a few scattered deciduous trees are present, or on coulisses from 300 to 350 feet wide, when sheltered by a curtain of wood, but prefer cuttings, whether artificial or natural. He therefore recommended that clearing the plots infested should be given up and that clearings should be made on various selected spots, which aimed at the creation of a curtain of wood round them, the density of which would prevent the cockchafers from ovipositing and at the same time allow the new growth of planted or naturally sown trees. The need for further research in the methods of controlling this pest is urged.

CHOLODKOVSKY (Prof. N.). **Афидологическія замѣтки.** [Aphid notes.] — **« Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xv, no. 2, 29th June 1915, pp. 147–148.

In a small collection of Aphids made in Germany and Russia were specimens of *Aphis hederae*, Kalt., taken at Munich on *Platanthera*

bifolia (false orchis) which flowers in May and June, whilst *A. hederae* is only to be found on ivy towards the end of summer and in autumn, this being a new case of Aphid migration from one species of plant to another. *Pachypappa vesicalis*, Koch, is very common on *Populus alba* in Esthonia, where this is not an indigenous tree, and the winged individuals oviposit on *Picea excelsa* in this part of Russia. *P. vesicalis* has also been found by the author on *Populus tremula*, and it is thought that the migrating individuals possibly live on the roots of *Picea*, their proboscis being fitted for such a life, though all attempts to find them on such roots have failed. Periodic emigrations of *P. vesicalis* from *Populus* to *Picea* are regarded as more or less certain. Tullgren has established an analogous migration for *Pemphigus xylostei*, De Geer.

Balabanov (M.). **Хозяйственныя наблюденія по борьбѣ съ вредителями въ садахъ.** [Practical observations on the control of pests in orchards.]—**«Плодоводство.»** [*Fruit-growing*], *Petrograd*, nos. 6 and 7, June and July 1915, pp. 357–363 and 422–427.

The author reviews various remedies for the control of insect pests and gives a diary of the measures to be undertaken in orchards at different seasons of the year. The practical farmer is not always in a position to adopt the particular methods or remedies suggested by the economic entomologist. There is frequently a choice of insecticides and those must be used which are best adapted to the local conditions, while the cost must especially be considered. As an example, sulphate of iron may often be replaced by milk of lime, and spraying with tobacco extract against *Psylla mali* can be replaced by simple fumigation. The reasons for the various operations are dealt with in a simple and practical manner, in order to assist those who have no technical knowledge.

Vassiliev (Eug. M.). **Мѣры борьбы съ свекловичной цвѣточницей.** [The control of *Pegomyia hyoscyami*, Panz.]—**«Вѣстникъ Сахарной Промышленности.** [*Herald of the Sugar Industry*], *Kiev*, no. 25, 4th July 1915, pp. 589–590.

Pegomyia hyoscyami, Panz., appeared in 1915 in smaller numbers than in 1914, owing to the fact that in the previous year about 60 per cent. of the larvae were infested with parasites. Injury to beet was also noticed later than in the previous years. The following remedies are suggested :—Against the imago, fermenting molasses ; against the larvae, spraying the leaves with a 5 or 6 per cent. solution of barium chloride, and the removal and destruction of the damaged leaves ; against the pupae, cultivation of the soil between the beds. The removal from the plantations of the following weeds, on which the pest oviposits, is also advised :—*Atriplex*, *Chenopodium*, *Spinaria*, *Silene*, *Datura stramonium*, *Hyoscyamus niger*, and *Onopordon acanthium* (Scotch thistle).

TREBINSKI (Dr. I.). **Отчетъ за 1914 г. о дѣятельности Станціи Охраны Растеній въ Варшавѣ.** [Report for 1914 on the work of the Station for the Protection of Plants in Warsaw.] Reprint from **« Ежегодникъ Варш. Общ. Сад.»** [*Warsaw Horticultural Society's Annual for 1914*], *Warsaw*, 1915, 88 pp., 5 figs.

The third annual report of the Station records experiments begun in 1913 [see this *Review*, Ser. A, ii, p. 514] with spraying operations against *Chermes abietis*, Kalt. These were repeated, the insecticide used being a mixture of tobacco extract with soap emulsion, which is prepared as follows:—1 lb. of machorka tobacco is boiled in 2½ gals. of water and left to stand for 24 hours; 1 lb. of green soap is emulsified in the same quantity of water and, before being used, both these solutions are mixed in the proportion of 4 volumes of the tobacco extract to 3 volumes of the emulsion, the whole being made up to 40 volumes with water. Of 12 fir trees sprayed with this preparation, no galls were observed at the end of summer on 10 of them, while the two others had only a few galls; a small number of galls were noticed on all the unsprayed control trees. The total destruction of this pest can, however, only be attained after several years of spraying. A table is given showing the results of spraying experiments against Aphids. A 2 per cent. solution of common washing soda with 2 per cent. by volume of linseed oil destroyed *Aphis cardui*, L. (*pruni*, Koch), on plums, *A. pomi*, De Geer (*mali*, F.) on apples, and *A. cerasi*, F., on blackberries. A 2 per cent. emulsion of linseed oil destroyed the majority of Aphids on plum trees, though it damaged the leaves at the tips of the shoots. A 2 per cent. solution of soda with 1 per cent. by volume of linseed oil destroyed all the Aphids on plum trees without damaging the foliage. A 6 per cent. solution by volume of Scalecide was effective, but scorched the leaves of apple and cherry trees, though not those of plums or sloes. A half per cent. solution by volume of lysol destroyed only a small number of Aphids. The same solution of lysol with half per cent. by volume of linseed oil destroyed all the Aphids on plums without damaging the foliage, though on apples, the young leaves were scorched. It is considered that 1 per cent. solution of washing soda with 1 per cent. of linseed oil is the best of all these insecticides. Some experiments were conducted with injections of carbon bisulphide into the soil, and even an injection of 10 cc. at a distance of one inch from strawberry plants did no damage whatever to them: it is possible that this result was due to the heavy soil. An injection of 5cc. of carbon bisulphide at a distance of 2 inches from wild apple trees caused scorching of the leaves, while an injection of the same amount at a distance of 1 inch resulted either in the death of the trees, or in serious scorching and dropping of the foliage. Spraying experiments against *Eriosoma lanigerum* on apple trees were also carried out: two heavily infested trees were sprayed on 24th March with kerosene soap emulsion (1 lb. of soap, 1 lb. of kerosene and 1 gallon of water), the spraying being repeated on the 31st of that month, with the result that this pest was not observed on these trees in April and May. Two trees were sprayed with a solution of 1 part of Scalecide in 6 parts of water, also on the above dates, with the same result. Two trees were sprayed with a commercial preparation sold as

"Mylonapht" with negative results. The ends of the branches of trees sprayed with kerosene soap emulsion withered in some cases, while in June the pest reappeared, although in small numbers, both on these trees and on those sprayed with Scalecide. The tips of the branches covered with Aphids were then cut away and burnt, while the thicker branches were sprayed with a strong jet of cold water, and no Aphids were noticed afterwards. It is thus concluded that under the climatic conditions prevailing in Poland, *E. lanigerum* can be successfully controlled by these means.

Goriatchkovsky (Vl.). **Вредители культурныхъ растенiй въ 1914 году.** [Pests of cultivated plants in 1914.] Reprint from *Warsaw Hortic. Society's Annual for 1914, Warsaw,* 1915, pp. 64–74, 3 figs.

This is a list of insect and other pests noticed during the year. On rye, the loss owing to thrips amounted in some cases to 20 per cent. On wheat, *Siphonophora cerealis*, L., and *Lema* sp., and on barley, *Siphonophora cerealis*, Kalt., *Tipula oleracea*, L., and *Lema* sp. were present. Other pests were :—on sugar beets, *Aphis rumicis*, L. (*papaveris*, F.), *Cassida nebulosa*, L., and *Pegomyia hyoscyami*, Panz. (*Anthomyia conformis*, Meig.) ; on buckwheat, *Tipula oleracea*, L. ; on beans, *Aphis rumicis*, L., *Sitones lineatus*, L., and *Phytomyza geniculata*, Macq. ; on cabbage, *Aphis brassicae*, L., *Pieris brassicae*, L., *Tipula oleracea*, L., and *Chortophila* (*Anthomyia*) *brassicae*, Bouché ; on apple trees, *Lepidosaphes ulmi*, L. (*Mytilaspis pomorum*, Bouché), *Eulecanium* (*Lecanium*) *pyri*, Schr., *Eriosoma lanigerum*, Hausm., *Aphis pomi*, De Geer, (*mali*, L.), *Laverna hellerella*, Dup., *Coleophora hemerobiella*, Scop., *Hyponomeuta malinellus*, Zell., *Anthonomus pomorum*, L., and *Epicometis hirta*, Poda ; on pear trees, *Eriophyes pyri*, Pgst., *Saturnia pyri*, Schiff., *Leucoptera* (*Cemiostoma*) *scitella*, Zell., *Zeuzera pyrina*, L. (*aesculi*, L.), and *Anthonomus pomorum*, L. ; on cherries, Coccidae and *Cheimatobia brumata*, L. ; on plum trees, *Eriophyes similis*, Nal., *Eriophyes padi*, Nal., *Aphis cardui*, L. (*pruni*, Koch), *Cheimatobia brumata*, L. and *Gryllotalpa gryllotalpa*, L. ; on gooseberry and red currant bushes, *Pteronus ribesii*, Scop. (*Nematus ventricosus*, Klg.) ; on cultivated roses, *Aulacaspis* (*Diaspis*) *rosae*, Bch., *Siphonophora rosae*, L., *Typhlocyba rosae*, L., *Hylotoma rosae*, L., *Ardis bipunctata*, Klg., and *Rhodites eglanteriae*, Hars. ; on lilacs, *Gracilaria syringella*, F., the second generation being specially numerous ; on privet, *G. syringella*, F., and *Otiorrhynchus rotundatus*, Sieb. ; on service trees, *Zeuzera pyrina*, L. ; on poplars, *Stilpnotia* (*Leucoma*) *salicis*, L. ; on elms, *Eriophyes brevipunctatus*, Nal., *Tetraneura ulmi*, De Geer, and *Gossyparia spuria*, Mod. (*Coccus ulmi*, L.).

Moritz (L.). **Отчетъ о борьбѣ съ саранчей посредствомъ парижской зелени и мышьяковисто-кислаго натра въ Хасавъ-Юртовскомъ округѣ Терской области въ 1913 году.** [Report on the control of locusts by means of Paris green and sodium arsenite in the Khasav-Jurtov district of the province of Terek in 1913.] Published by the Department of Agriculture, *Petrograd*, 1914, 19 pp., 1 plate. [Received 20th September 1915.]

The author was deputed in 1913 by the Department of Agriculture

to assist in the campaign against locusts in the province of Terek, and he supervised the work in the Khasav-Jurtov district, where over 16,500 acres were infested with the egg-clusters of *Locusta migratoria*. For the purposes of the campaign, the district was divided into sections, separate groups of workmen under a separate instructor being provided for each. The total number of workmen engaged was 206, the rate of pay varying from 1s. 5d. to 2s. 1d. per diem in the case of those working on foot and being higher or lower in accordance with the conditions of the ground, and 4s. to 6s. per diem for those working with horse-sprayers. The machines used were 10 Vermorel horse-sprayers, and 100 Automax and 31 Vermorel hand-sprayers. The area infested with egg-clusters included reeds, meadows and fields, the largest number being concentrated in reed-beds near water, where an average of 5 to 9 clusters was found approximately on every 5 square feet. The campaign was conducted entirely by means of the chemical method and consisted of spraying with Paris green and lime and with sodium arsenite and zinc oxide. The first-named insecticide was prepared as follows :—3 to 5 lb. of green in accordance with the age of the locusts (3 lb. being taken for those of the first three stages and 4 to 5 lb. for those of the last two) were dissolved in about 3 gallons of water and were mixed with a solution of 6 to 10 lb. of freshly slaked lime in about 3 gallons of water, the whole being then diluted with 30 to 40 gallons of water. The second insecticide was prepared in the same way, 2 lb. zinc oxide being used instead of the lime ; to make it adhesive, a solution of 1½ lb. of soap in 3 gallons of water or from 10 to 12 lb. of black molasses were added to each 80 gallons of the above insecticides, this being specially important when spraying reeds. The sodium arsenite insecticide was used exclusively for hand-sprayers, about 2½ lb. of it being required per acre, while the Paris green was almost exclusively used with the horse-sprayers, the same quantity being required per acre. Sodium arsenite caused the death of the locusts to begin 15 hours after spraying and they were all killed within 24 hours. Paris green gave the same results after three days, the locusts beginning to die about 24 hours after spraying ; individuals of the first and second stages succumbed more rapidly. The total cost of the work was about £1,100, of which £700 was paid in wages ; a total area of 5,073 acres was sprayed, the cost per acre thus being about 4s. 4d.

MEDYNSKY (V. E.). **Дешевый и радикальный способъ борьбы съ садовыми вредителями.** [A cheap and radical remedy for the control of pests of orchards.]—**« Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-growing and Market-gardening*], *Petrograd*, no. 28, 25th July 1915, pp. 780–781.

An insecticide prepared from thorn apple (*Datura*) is said to be as effective as Paris green, green soap and similar remedies. The method of preparation is as follows : a ripe and dry plant, consisting of stalk, leaves and seed, is chopped up and boiled in a closed boiler containing about 27 gallons of water for every 100 lb. of the plant, until half the water is evaporated ; the liquid is then strained and the strengths required for actual use obtained by mixing two parts

of it by volume with from 1 to 4 parts of water ; to every 27 gallons of this solution 5–15 lb. of molasses, rye paste or boiled starch are added. This insecticide is effective against Aphids, various caterpillars, cockchafers, etc., killing them in a very short time.

Paleitchuk (O. N.). **Къ борьбѣ съ ноземой пчелой.** [On the control of *Nosema apis*.]—**«Земледѣлецъ.»** [*Agriculturist*], *Petrograd*, xx, no. 6, June 1915, pp. 271–274.

The author reports on an outbreak of *Nosema apis* and recommends the following treatment for the disease :—The first day, the queen bee should be removed into the cell, or, if this is impracticable, either the open brood must be removed or have mature, sealed brood added to it sufficient to create an abundance of bee-nurses ; the bees must be fed with a mixture consisting of $1\frac{1}{2}$ pints of boiling water, 15 grams of Alexandria senna leaves, 1 grm. of cream of tartar, 1 tablespoonful of tincture of cascarilla and 1 pint of honey (the water is poured over the senna leaves and the cream of tartar, tightly closed and left in a warm oven for from 12 to 24 hours, when the extract is decanted and the remaining ingredients added to it) ; about $\frac{1}{4}-\frac{3}{4}$ pint is allowed for one family according to its strength. Feeding in the evening should be done with 2 pints of boiled water, 1 teaspoonful of phosphoric acid and $\frac{1}{2}$ pint of honey. The second day, the bees must be removed in the evening into the disinfecting hives and the size of the nest reduced by removing the combs or those parts of them which contain traces of the excreta ; if there are any drones, drone-traps must be put at the entrance holes ; the queen bee should be left in the cell and the hive fed on $1\frac{1}{2}$ pints of boiling water, 1 grm. of cream of tartar, 2 grms. of citric acid, 1 pint of honey, 1 tablespoonful of tincture of cascarilla and 1 tablespoonful of spirits of camphor (the water is poured over the cream of tartar and citric acid and allowed to cool down to about 110° F., when the honey is added and dissolved, then the cascarilla, and after stirring, the spirits of camphor), $\frac{1}{4}-\frac{3}{4}$ pint being the dose for one family. The third day, feeding in the evening is done with the same mixture as on the evening of the first day. The fourth day, feed in the evening with a mixture consisting of $1\frac{1}{2}$ pints of boiling water, 2 grms. of peppermint, 1 grm. of cream of tartar, 1 pint of honey, 1 tablespoonful of tincture of cascarilla and 2 grms. of formic acid (the water is poured over the peppermint and cream of tartar, tightly closed and put into a hot oven for 12 to 24 hours, after which the extract is decanted, the honey added and dissolved in it, and the other ingredients added and stirred), $\frac{1}{4}-\frac{3}{4}$ pint being given to one family. The fifth day, feed in the evening with the same mixture as in the evening of the first day. The sixth day and onwards, pieces of camphor, of the size of a large hazelnut, wrapped in gauze, are placed on the bottom of the hives and renewed as they evaporate. The drones of diseased hives ought to be caught and burned ; the hives must be well ventilated; in localities where the disease is prevalent, the above treatment ought to be generally applied as a preventive remedy in the first half of each month between March and August, but it is not necessary to isolate the queen bee.

MOKRZECKI (S. A.) & BRAGINA (A. P.). **Отчетъ Энтомологическаго Кабинета Салгирской Опытной Плодоводственной Станціи за 1913-1914 гг.** [Report of the Entomological Laboratory of the Experimental Horticultural Station of Salgir for 1913-1914], *Simferopol*, 1915, 9 pp.

This is the first report for the first two years of the existence of the Laboratory and a brief summary of the work done there is given. Observations on *Cydia pomonella* showed that $19\frac{1}{2}$ per cent. of the caterpillars hibernating in 1913 were infested with Tachinid parasites, while in 1914 this number reached 27 per cent. In 1913, only one generation occurred, the majority of the caterpillars of the first generation having hibernated, but in 1914 this was the case only with a small number and two full generations were on the wing, there being traces of a third generation also, as some freshly hatched caterpillars were found at the end of September. *Trichogramma fasciatum* Perk. (*embryophagus*), and *T. semblidis*, Aur., both occur in the Crimea. The former infests about $1\frac{1}{2}$ per cent. of the eggs of *C. pomonella*, while the latter was not found in these eggs in the open, where it attacked eggs of *Barathra brassicae*, *Phytometra* sp., *Pieris rapae* and others ; in the laboratory, however, it freely infested them. Twenty-five generations of *T. fasciatum* were reared from one parasite, without any males making their appearance, at a temperature of 32° C., the whole development from the moment of infestation to the imago lasting rather less than 8 days. Large outbreaks of *Lymantria dispar* occurred in 1912 and 1913. About 25 per cent. of the caterpillars were infested by Tachinids, while about 10 per cent. perished from flacherie. The number of the pupae was also reduced by Tachinids. As many as 5 local species of *Psylla* were identified. *P. pyrisuga* had one generation in 1913, while in 1914 the females issued in September from their hibernating places and proceeded to oviposit, which shows that the number of generations of this insect may vary with the climatic conditions. Studies were also conducted on *Eucosma* (*Tmetocera*) *ocellana*, F. ; *Recurvaria* (*Gelechia*) *nanella*, Hb. ; *Coleophora gryphipennella*, Bch. ; *C. anatipennella*, Hb. ; *Olethreutes variegana*, Hb. ; *Tinea fuscipunctella*, Hw. ; *Tortrix* (*Pandemis*) *corylana*, F. ; *Tortrix* (*Cacoecia*) *crataegana*, Hb. ; *Cerostoma persicellum*, F., and some others. Observations on *Ino ampelophaga* tend to show that the number of its generations depends on climatic conditions ; in 1914, two generations were on the wing and oviposited, but some of the caterpillars of the first generation, as well as those of the second, remained over the winter.

Emphytus truncatus, Kl. (*fulvipes*, Fall.), produced four generations in one summer ; parthenogenesis was observed in this sawfly, although males exist. Stores of dry tobacco were injured by *Ephestia elutella*, Hb., the life-history of which has also been studied, as well as that of *Rhynchites pauxillus*, Germ., a new parasite of which was reared, the Mymarid, *Anaphinis* sp., infesting as much as $18\frac{3}{4}$ per cent. of its eggs. Against *Gryllotalpa gryllotalpa*, L., successful experiments were carried out under natural conditions with sodium arsenite and carbon bisulphide. *Melasoma* (*Lina*) *populi*, L., *M. tremulae*, F., *Euproctis* (*Porthesia*) *chrysorrhoea*, L., *Malacosoma* (*Gastropacha*) *neustria*, L. and *Tortrix laevigana* were also investigated.

Emploi de l'eau chaude contre les parasites de la vigne. [The use of hot water against vine-pests.]—*Progrès Agric. Vitic., Montpellier,* lxiv, (32nd year), no. 28, 11th July 1915, pp. 34–35.

In view of M. Semichon's suggestion that further trials in the control of vine-pests with hot water [see this *Review*, Ser. A, ii, p. 685] were desirable, MM. Salomon of Thomery have made tests both in the vineyard and greenhouse. In the vineyard, a Vermorel Pyralis boiler was used in conjunction with a Muratori constant jet-sprayer of 10 litres capacity. The shade temperature was 75° F. The water had a temperature of 162° F. when pumped into the sprayer. At first the jet issued at 150° F., but fell to 136° F. in the 15 minutes necessary to empty the container, 45 stocks, each bearing from 15 to 18 bunches, being treated during that period. The operator pushed aside the leaves in order to uncover the bunches; three times the ordinary quantity of spray liquid was used. At the date of spraying (28th May), examination of the bait-traps proved that the first flight of *Clysia ambiguella* and *Polychrosis botrana* was over. Eight days after treatment the following counts of living larvae were made per 100 treated bunches; 67, 70, 71, 85 and 97, the corresponding figures on the alternate control rows being 248, 255, 288, 314 and 485. On the treated bunches the living larvae were only found in protected parts, while on the untreated control bunches they were found in all parts. This proves that hot water of 136° to 150° F. destroys all unsheltered eggs and larvae. Total destruction requires several successive applications, entailing an expense out of proportion to the benefits derived. In the greenhouse, any boiler may be employed; the Muratori hand-sprayer, of 2 litres capacity, was used. The indoor temperature was 85° F. The water was pumped into the sprayer at exactly 150° F. and issued between 144° and 150° F. The sprayer was constantly warmed up. Each bunch was sprayed for five seconds and here also the only larvae which survived were those under shelter. Some tests were conducted with water at 159° F. sprayed for three seconds and this killed all the larvae, including those under shelter. Spraying with water at 139° F. was successfully carried out against black and green Aphids on a peach tree without injury to the foliage.

FONZES-DIACON (—). **Sur les poudres cupriques.** [Cupric dusting powders.]—*Progrès Agric. Vitic., Montpellier,* lxiv (32nd year), no. 28, 11th July 1915, pp. 37–41.

Like cupric solutions, cupric dusting powders may be divided into acid, neutral and alkaline varieties. The acid powders contain copper which is soluble in water, and on being wetted, they act immediately on the mildew spores. They also contain insoluble copper which may be rendered soluble with the aid of the carbonic acid dissolved in water and thus also have a retarded action. If they are too acid, they may scorch the vine, sometimes injuring the foliage and the grapes. The neutral powders only contain copper which is insoluble in water and present in the form of compounds of varying chemical composition, but capable of more or less rapid solution in rain water and dew charged with carbonic acid. Their anticryptogamic action is thus

always retarded. As regards the alkaline powders, the anticryptogamic action they derive from the insoluble copper which they contain is nil. It is possible that dusting with an alkaline powder after spraying with an acid cupric solution may lead to the action of the latter being neutralised. There is a very simple method of determining in which of these three classes a cupric dusting powder may be placed. About $\frac{1}{4}$ oz. of powder is put into a tall tumbler which is nearly filled with water. The contents are stirred for about an hour with a rod and then allowed to clear by settling. A large, bright iron nail is put through a piece of cardboard which covers the mouth of the tumbler so that a portion of the nail is submerged. With an acid powder this portion will blacken, and the speed with which it does so will depend on the degree of acidity; a very rapidly formed, deep black colour shows that there is a danger of scorching the leaves and also perhaps the grapes. Neutral and alkaline powders do not act on the iron. To differentiate between these, about $\frac{1}{4}$ oz. of powder is placed in a tumbler and the jet from a Seltzer siphon is directed into it until nearly full. After some time, bicarbonate of copper is formed. After stirring for about an hour a nail is placed in position as described above and it will gradually turn brown with a neutral powder, an alkaline powder producing no reaction.

The base of most acid powders is talc or steatite, a natural product composed of silicate of magnesia and obtainable in the form of a very fine powder, which is soapy to the touch. This steatite is usually impregnated with copper sulphate, though sometimes verdigris or neutral acetate of copper is employed for the purpose. During the process of impregnation, the impurities in the steatite cause reactions which render the major part of the copper insoluble. These reactions may continue after the powder is placed in bags. Old powders are therefore less acid—and hence less rich in free copper sulphate—than freshly manufactured ones. Neutral powders are produced by the same means, but the impurities in the talc are present to a greater extent, so that all the copper sulphate is rendered insoluble. It sometimes happens that the talc has simply been mixed with copper hydrocarbonate or another insoluble copper compound. Such mixtures cannot immediately yield soluble copper to rain water or dew. The alkaline powders are based on finely sifted lime: the copper is quite insoluble in water and the greater part of it is present as black copper oxide, which is one of the forms of copper least soluble in carbonic acid.

Semichon (L.). **L'invasion de Pyrales et la destruction des pontes.** [The invasion of the vine tortrix and the destruction of its eggs.] — *Rev. Vitic., Paris*, xliii, no. 1098, 15th July 1915, pp. 37–42.

The damp weather of 1915 has been very favourable to the vine moths, *Clysia ambiguella* and *Polychrosis botrana*, and to the vine tortrix, *Sparganothis pilleriana*. The last-named has never before been observed in such numbers in Aude and urgently needs control. The crushing of the caterpillars is a very costly method. Insecticides are not sufficiently efficacious, because this pest appears when the young vine shoots are growing most vigorously and daily exposing new tissues. In consequence, to be of real use, spraying would have

to be carried out daily. Furthermore, the caterpillar of *S. pilleriana* usually weaves its covering before it begins to feed. Bait-traps and light-traps are not of much value, as the period of flight is very short. Fumigation with sulphurous acid, painting with an insecticide wash in winter and sluicing with hot water are all efficient measures and should be applied in the months of February, March and April. Their cost is the chief objection. The collection of the leaves bearing egg-masses and their destruction by fire is an old method which merits attention, and the cost of collection may be considerably diminished if the leaves are stored for fodder. The author has filled casks with successive layers of leaves, each layer being sprinkled with salt. Enough water is poured in to cover the leaves and some is drawn off each time a portion of the leaves is taken for fodder. The destruction of the egg-masses with hot water [see this *Review*, Ser. A, ii, p. 685 ; iii, pp. 522, 614] is very efficacious and costs but little ; a period of two weeks is available for its application. It is superior to winter controls, though the latter must not be neglected.

SEMICHON (L.). **La Cochylis et l'Eudémis et la destruction des oeufs.** [*Clysia ambiguella* and *Polychrosis botrana* and the destruction of their eggs.]—*Rev. Vitic., Paris,* xliii, no. 1099, 22nd July 1915, pp. 53–58.

Hitherto, the only control measures of any real value against the vine-moths, *Clysia ambiguella* and *Polychrosis botrana*, have been the sluicing of the vine-stocks with hot water in October and November, the trapping of the moths and the application of insecticides. The first only destroys the individuals in the bark ; the second is only applicable for a very short time and a large number of the moths always escape capture, especially when the moon is bright ; the third is defective in spring, because the plant tissues grow very rapidly and unsprayed surfaces are quickly being exposed, and also on account of the short period (five or six days) during which the caterpillars are vulnerable. Insectifuge powders are very unsatisfactory ; nicotine solutions are somewhat better and are the only ones suitable after flowering. The destruction of the eggs and young larvae by spraying with hot water is a new and better method which destroys all the insects, provided it is carried out thoroughly ; all the individuals of a generation are present on the vine and in a very vulnerable form, and from 15 to 20 days are available for treatment, which may therefore be thorough. The cost varies from 6s. 6d. to 8s. per acre, or only about one-quarter the cost of sluicing in winter. If the hot liquid is applied in the form of a cupric spray against mildew, the expense for insect control becomes nominal.

Hot water is also very efficient in controlling *Colaspidema atrum* and the black Aphid of beans.

WADSWORTH (J. T.). **On the Life-history of** *Aleochara bilineata*, **Gyll., a Staphylinid parasite of** *Chortophila brassicae*, **Bouché.**—*Jl. Econ. Biol., London*, x, nos. 1 and 2, June 1915, pp. 1–26, 1 fig., 2 plates.

In addition to the Staphylinids, *Aleochara bilineata* and *A. nitida*, the following Hymenopterous parasites have also been bred from the

puparia of *Chortophila brassicae* (cabbage-root fly) :- Ichneumons, *Atractodes tenebricosus*, Grav., and *Phygadeuon fumator*, Grav ; Cynipid, *Cothonaspis* (*Eucoila*) *rapae*, Westw. Puparia of *C. brassicae* were collected from market-gardens and allotments in the vicinity of Northenden and Sale, Cheshire, during every month in 1914, except April and May, and in the early months of 1915. Puparia of this fly may be found throughout the year wherever cabbages and related vegetables are grown ; those of the first brood occur in June and July, those of the second in August and September. During the succeeding months, until the following May or June, they are present in the soil. It is uncertain whether these belong to the second or a subsequent generation. Parasitised pupae were detected by examination under a low power microscope ; they were then placed, until required, in boxes containing moistened sterilised sand. No difficulty was experienced in obtaining fertile females, ova, and larvae of the Staphylinid in captivity. Living larvae and the extracted contents of puparia of the cabbage fly were given to the beetles for food. If puparia were placed in the breeding-boxes for the newly-hatched larvae to enter and if proper conditions of moisture and ventilation were maintained, the complete developmental cycle could be observed. Experiments were made with the object of hastening the development of the larvae during the winter, by subjecting infested puparia to moist, warm conditions. The temperatures varied from 60·5° F. at night to 74·5° F. in the day, during the period from 8th January to 8th February 1915. Adult beetles were obtained in one month from the time the infected puparia were placed in the warm room ; normally, these adults would have emerged in May or June. The ova of *A. bilineata* are deposited in the soil, near the roots of cabbages, etc., which are attacked by the larvae of *C. brassicae*. The larvae hatch in from 10 to 12 days. Their natural habitat is below the surface of the soil. In order to complete development, it is essential for them to enter Dipterous puparia ; whether they are restricted to the puparia of *C. brassicae* is at present undetermined. Three small Anthomyiid puparia, apparently distinct from *C. brassicae*, and containing Staphylinid larvae, were found during the winter ; a very small adult *A. bilineata* was reared from these. The time required by the larva in effecting an entrance into the puparium is apparently very considerable. The young larvae probably puncture the pupal cuticle and ingest the semi-fluid contents. In summer from 12 to 18 days elapse from the completion of feeding to the last larval ecdysis and appearance of the pupa. The pupal stage lasts about the same time. In captivity, adults attacked larvae and occasionally pupae of *C. brassicae*. From infected puparia collected at the end of March 1914, the first adult beetle emerged on 20th May, the last on 23rd June. Under out-door conditions emergence would probably have been later. Cabbage-fly puparia resulting from the first brood of flies, were collected at the end of June and early in July ; some of these contained first stage Staphylinid larvae. Judging from the results obtained by subjecting larvae to warm conditions, and also from the time occupied for the development of the summer brood, it seems probable that three or more generations might be produced under warm climatic conditions, though, in the vicinity of Manchester, there is no evidence to show that three generations normally

occur. The number of puparia parasitised in the summer months is much higher than in those collected in winter and spring. Of the total number of puparia examined, 10·9 per cent. were parasitised by *A. bilineata* and *A. nitida*, while a certain number of both larvae and puparia were destroyed by the adult. The Staphylinids therefore are important in checking the increase in numbers of *C. brassicae*. About 10 per cent. of the puparia examined were parasitised by Hymenoptera. Increase in the number of parasites in badly infested areas would probably give good results.

Farming Calendar.—*Rhodesia Agric. Jl., Salisbury*, xii, no. 3, June 1915, pp. 397–400.

The cabbage louse [*Aphis brassicae*], and the bagrada bug [*Bagrada hilaris*] attack plants of the cabbage family during June. Onion thrips [*Thrips tabaci*] during June and July can be controlled by dipping the transplanted seedlings as far as the roots in tobacco wash or paraffin emulsion. The winter crop of the fig can be protected from fig weevil [*Omophorus stomachosus*] by the destruction of infested fruit during June. Deciduous fruits infested with scale-insects should receive a winter wash of lime-sulphur during July. The citrus codling moth [*Argyroploce leucotreta*] infests guavas when no citrus fruit is available. All guava trees in the vicinity of citrus orchards should therefore be stripped during July or August and the fruit buried deeply or burned.

Urich (F. W.). **Locusts and Methods of destroying them.**—*Bd. Agric., Trinidad and Tobago, Port-of-Spain*, Circ. no. 13, 31st May 1915, 6 pp.

Locusts which may migrate to Trinidad from Venezuela may be expected to be the South American migratory species. Large swarms were reported to have invaded Ciudad Bolivar about the middle of January and were flying in a north-easterly direction. At that time, it was stated by the author that as long as the swarm did not reach the Gulf States of Venezuela, an invasion of Trinidad was not likely to take place. In 1885, the first places in Trinidad to be invaded were Chacachacare, Monos and Chaguaramas. Methods of destruction by lead arsenate and sodium arsenite sprays and by poisoned bran mash are given. The mycologist's report for the month of April gives the species as *Schistocerca paranensis*, a very destructive species in South America.

Sherman (F.). **San José Scale; Orchard Spraying and Orchard Protection.**—*North Carolina Dept. Agric., Raleigh*, Bull. no. 209, June 1915, 67 pp., 10 figs.

The life-history of *Aspidiotus perniciosus* (San José scale) in North Carolina is as follows. Breeding begins at Raleigh from March to May. Maturity is reached in from 30 to 40 days. There are probably from 5 to 8 generations a year, the period of most rapid increase being August and September. The winter is passed in the immature stage. *A. perniciosus* is able to breed in any part of the State, since it has been recorded at sea-level in Brunswick county in the south-eastern

part of the State, and at an altitude of over 4,000 ft. in Watauga county in the north-west, and is destructive in both places. The best method of control is spraying with lime-sulphur wash or soluble oil during the dormant season. The following formula is recommended for home-made lime-sulphur: stone lime (unslaked) 15 lb.; flowers of sulphur 15 lb.; water 50 U.S. galls. Winter pruning should be carried out before the trees are treated for scale. A table for spraying apples, pears, peaches and plums is given. It is not advisable to use Bordeaux mixture on peaches and apples until after the young fruits are well formed. The following formula is given for Bordeaux mixture and lead arsenate: stone lime (unslaked), 4 lb.; copper sulphate, 3 lb.; lead arsenate paste, 3 lb.; water, 50 U.S. galls. Self-boiled lime-sulphur wash is prepared according to the formula: stone lime, 8 lb.; sulphur, 8 lb.; water, 50 U.S. galls.; lead arsenate paste, 3 lb. Kerosene emulsion, for spraying peach and plum, should be used at a strength not greater than 15 per cent. oil in winter and early spring and not greater than 10 per cent. oil in summer. For use on apple and pear, 25 or 50 per cent. oil can be applied in winter and until the buds open in spring; for later spraying 15 per cent. oil is advised.

SAUNDERS (G. E.). **Spraying with Arsenates in Nova Scotia.**—*Canadian Horticulturalist, Peterboro, Ont.*, xxxviii, no. 7, July 1915, pp. 169–170, 1 table.

During 1912 and 1913, an experiment was conducted to determine the extent of benefit derived from each of the four sprays then applied to the orchards of the Annapolis Valley in controlling bud-moth [*Eucosma ocellana*], fruit worm [*Rhagoletis pomonella*], and codling moth [*Cydia pomonella*]. The spray used was commercial lime and sulphur, 1 to 35, and Swift's acid paste lead arsenate, 5 lb. to 100 gals. The first application was made when the buds were bursting, the second, 2 or 3 days before the blossoms opened, the third, immediately after the blossoms fell, and the fourth, 2 weeks later. The infestation of bud-moths on the unsprayed control trees at the end of the experiment, was 59·56 per cent., while in the plots receiving the second and third spray the average was 22·1 per cent. The infestation of fruit worms at the end of the first season on the controls was 12·44 per cent. of injured apples; in plots receiving the second and third spray the injury was 4·33 per cent. The codling moth infested 4·54 per cent. of the apples on the controls in 1913. It was found that the second spray gave 71·3 per cent. reduction in injury, the third spray, 89·2 per cent., the fourth, 65·6 per cent. From the fact that the codling moth is, as a rule, of minor importance in Nova Scotia, apple growers are free to advance or retard the first spray after the blossoms by 2 or 3 days, as may be advantageous to them in controlling any other pest, with practically no reduction in benefit as regards codling moth. The injury done by the three insects under observation was divided into 2 classes: (1) reduction in the set of fruit, (2) injury to picked fruit. In the experimental orchard 59·56 per cent. of the buds in the controls contained bud-moth. Counts of 1,000 infested blossom clusters showed 305 apples set, while 1,000 clusters free from moth on the same trees, set 1,205 apples. Reduction in the set of

blossoms was 75 per cent. By the use of the second and third spray, the number of moths was reduced by 60·75 per cent. Observations during June showed that 72·48 per cent. of young fruit injured by fruit worms dropped before maturity. The second and third spray reduced this injury by 65·19 per cent. The 12 plots averaged 44·7 per cent. bud-moth infestation in the buds and 9·5 per cent. of the leaves showed injury. The most marked results were in all cases obtained from the second and third sprays. The cost of these sprays in Nova Scotia is, on the average, $2\frac{1}{2}d.$ per barrel. The results recorded did not take into account any benefit derived from black spot control.

BRYSON (J. M.). **Troublesome Rose Pests and their Cure.**—*Canadian Horticulturalist, Peterboro, Ont,* xxxviii, no. 7, July 1915, pp. 171–172.

The carpenter bee causes serious injury to roses by mining in the shoots during the larval stage. The only method of control is to cut the shoot below the affected region, or in cases of bad infestation, to destroy the bush. The insect is most prevalent during June and July and again in October. Green and brown aphis, attacking the leaves in June and July, are readily controlled by spraying with whale-oil soap, at the rate of ½ lb. to 5 gals. water. Sawflies are destroyed by the use of hellebore powder, 1 oz. in 4 gals. water, together with a small quantity of molasses. The rose beetle, attacking young buds, can only be removed by hand-picking.

STRICKLAND (E. H.). **Poisoned Bait for Cutworms.**—*Canadian Entomologist, London, Ont.,* xlvii, no. 7, July 1915, pp. 201–204.

Experiments conducted by the author at the Dominion Entomological Laboratory at Lethbridge, Alberta, during the past two years upon the control of the cutworms, *Porosagrotis orthogonia* and *Euxoa ochrogaster*, and again this spring upon a species of *Euxoa* (*Chorizagrotis*), have proved that shorts [see this *Review*, Ser. A, iii, p. 564] are far more valuable than bran as a poison bait. Under the semi-arid conditions of a region where there is no dew at night, it seems impossible to obtain a bran mixture that will remain sufficiently attractive after it has lost its moisture, some fifteen minutes after its application to the heated soil. The following formula gives the best results in the control of *E. ochrogaster* and *P. orthogonia*: Shorts, 50 lb; molasses, ½ gal.; Paris green, 1 lb., and water, 2½ gals. This costs from 4*s.* to 5*s.* per acre for the ingredients alone, but since cutworms nearly always begin to do damage in small, well-defined areas, from which they subsequently spread, prompt treatment, as soon as damage is seen, reduces the cost per acre of the area saved to a small figure. For *E. ochrogaster* the unharrowed plots gave slightly better results than the harrowed, and it was observed that this species feeds more frequently above the ground than does *P. orthogonia*. The superiority of shorts over bran has been again established in the control of army cutworms, *Euxoa agrestis*, which invaded part of Alberta early this year. Owing to the migratory habits of this species, results from field experiments are rather uncertain; definite results were obtained in

specially constructed field cages. Comparisons show that the value of poisoned shorts is certain, while the application of poisoned bran is of very doubtful benefit when judged from the aspect of cost and results. The following mixture was found to be excellent: Shorts, 50 lb., molasses, 2 gals., Paris green, 1 lb., applied at the rate of 20 lb. per acre. In this case no water was used. The addition of Paris green in greater quantities does not warrant the extra cost.

GIRAULT (A. A.). **A new genus and species of Trichogrammatidae from the Philippines.**—*Canadian Entomologist, London, Ont.*, xlvii, no. 7, July 1915, pp. 233–234.

Pseudobrachysticha semiaurea, gen. et sp. n., is described from a large number of specimens of both sexes reared from the eggs of a Jassid, *Hilda breviceps*, Stål, in the Philippine Islands, in February 1915.

JOHNSTON (F. A.). **Asparagus Beetle Egg Parasite.**—*Jl. Agric. Research, Washington, D.C.*, iv, 15 July 1915, pp. 303–313, 1 plate.

Experiments on the life-history of the Chalcid, *Tetrastichus asparagi*, Crawf., parasitic upon *Crioceris asparagi*, L., are described. This *Tetrastichus* is probably present in many localities in the north-eastern part of the United States. It is attached exclusively to the asparagus beetle, which it destroys both by devouring the eggs and by ovipositing in them. The parasitised egg hatches, but the beetle larva after reaching maturity and forming its cell, fails to pupate. There are two or even three generations of this parasite annually and it is regarded as an important enemy of the beetle. It does even more useful work in devouring the eggs than as an internal parasite. Since the parasitic larva passes the winter in the soil in the pupal cell of its host, it would appear that the parasite might easily be transported from one place to another in the soil which might surround a consignment of asparagus roots.

QUAYLE (H. J.). **The Control of Citrus Insects.**—*California Univ. Agric. Coll. Expt. Sta., Berkeley*, Circular no. 129, May 1915, 36 pp., 18 figs.

Fumigation provides the best control for citrus scale-insects. Detailed particulars of the method are given in this paper, including fumigation dosage tables for sodium cyanide at the 75, 85, 100 and 110 per cent. schedules. Potassium cyanide from Germany was formerly used, but sodium cyanide is now exclusively employed, because of its lower cost and source of supply, it being now manufactured in the U.S.A. The sodium cyanide for fumigation is of 129 per cent. purity, on the basis of 100 per cent. potassium cyanide; it is usually obtainable in the form of egg-like lumps known as cyanegg and costs from 11d. to 1s. 2d. per lb. The acid used is commercial sulphuric acid of 66° Bé., or about 93 per cent. pure, and costs from ¾d. to 1d. per lb. In this process of gas production, water is added to the acid for a threefold reason: the water dissolves the coating formed on the cyanide by the acid; its admixture with acid generates heat, which promotes the production of gas; it increases the volume

of the liquid, which is important in covering the cyanide when a small dosage is used. For sodium cyanide, the proper proportions for securing the maximum amount of gas are as follows :—sodium cyanide, 1 oz. avoirdupois ; sulphuric acid, 66° Bé., 1¼ fluid oz. (U.S.) ; water, 2 fluid oz. (U.S.). The dosage tables are based on this formula and vessels are provided which are properly graduated for it. With these vessels, if a tree requires 12 oz. of cyanide, the acid pitcher is filled to the 12 mark with acid and the water pitcher to the 12 mark with water. A fumigating outfit of 30 tents operated by five men can treat about 400 trees a night. The cost per tree varies from 10d. to 6s. 3d., the average being between 1s. 0½d. and 1s. 3d. A portable generating machine is now commercially obtainable. Only a minute or two is required for producing the gas. Other advantages are : accuracy of dosage, economy of material, cleanliness of manipulation, one man less required, and freedom from acid burns on the tents. The machine is mounted on two wheels. It consists of a central barrel-like drum, which encloses a smaller vessel in which the generation of gas takes place. To one side, and above this, is a vessel containing the cyanide which is dissolved in the required amount of water. On the other side is another vessel which contains the acid. The cyanide solution and the acid are conducted into separate graduated glass cylinders for the dosage and then directed together into the generating vessel. As this is within a larger vessel, the only outlet is through a rubber tube, which conducts the gas under the tented tree. A new portable generating machine of different construction, and working on somewhat different principles, is also illustrated, but not described, in this paper. Though spraying is not recommended for citrus scale-insects, this method is dealt with at length and several formulae are given, kerosene and distillate emulsions being preferred [see below]. Spraying is now very generally used throughout the citrus belt for the control of red spiders and mites, an alternative treatment being provided by the application of dry sulphur, the cost of which is about one-half that of spraying. In spraying, commercial lime-sulphur is now very generally used : commercial lime-sulphur, 4 or 5 gals., and water, 200 gals. Some growers add flour paste to ensure enhanced spreading and adhesion properties. From 6 to 8 lb. of flour are mixed in as many gallons of water, the mixture is brought to the boil and added to a 200-gallon tank of spray solution. The dry flour may also be added to the spray. Where mites are especially persistent, it is desirable to add 15 or 20 lb. of dry sulphur to the commercial lime-sulphur spray.

The citrus pests recorded in this paper are : *Saissetia oleae*, Bern. (black scale), *Chrysomphalus aurantii*, Mask., and *C. aurantii* var. *citrinus*, Coq. (red and yellow scales), *Lepidosaphes beckii*, Newm. (purple scale), *Coccus citricola*, Campb. (citricola scale), *Coccus hesperidum* (soft brown scale), *Aspidiotus rapax*, Comst. (greedy scale), *Aspidiotus hederae*, Comst. (oleander scale), *Icerya purchasi*, Mask. (cottony cushion scale), *Pseudococcus citri* (citrus mealy bug), *Tetranychus mytilaspidis*, Riley (citrus red spider), *Tetranychus telarius*, L. (*sexmaculatus*, Riley), *Eriophyes oleivorus* (silver mite), *Scirtothrips* (*Euthrips*) *citri*, Moul. (citrus thrips), *Tortrix citrana*, Fern. (orange tortrix), *Pantomorus* (*Aramigus*) *fulleri*, Horn (Fuller's rose beetle), a species of *Diabrotica* and Aphids.

Quayle (H. J.). **The Citricola Scale.**—*California Univ. Agric. Coll. Expt. Sta., Berkeley,* Bull. no. 255, May 1915, 17 pp., 7 figs., [Received 10th August 1915.]

The bulk of this paper has already been abstracted [see this *Review*, Ser. A. iii, p. 457]. Against *Coccus citricola*, where fumigation is not feasible, spraying may be employed. The kerosene emulsion spray has proved the safest as regards injury to the tree or fruit, whilst being effective in killing the scales. The kerosene spray is a mechanical mixture of kerosene and water. The oil is used at a strength of from 8 to 10 per cent. and is mixed mechanically with water by agitation in the spray tank. The oil used has the trade name of "Water white" or "W.W." and is a cheap kind of kerosene with a gravity of 42° Bé. By adding soap, an emulsion is obtained which the author considers superior: "W.W." oil of 42°, 15 U.S. gals.; liquid soap, ¾ gal. (or hard soap 4 lb.); water, 200 gals. The materials are mixed in the same way as for the following distillate emulsion: tree distillate of 31°–32°. 4 U.S. gals.; liquid soap, ¾ gal. (or hard soap, 4 lb.); water, 200 gals. To prepare this spray, first place the soap (hard soap must first be dissolved in hot water) in the spray tank with 10 or 15 gals. of water. The engine is started and the emulsion is made by the materials being run through the pump under pressure. After a few moments, the rest of the water may be added, with the pump still working. The spray is then ready for use, and should be directed almost entirely against the underside of the leaves. Two angle-nozzles on a Y at the end of each rod is the best arrangement. They should not throw too course a spray, otherwise too much material will be used if any attempt at thoroughness in covering all parts of the tree is to be made. Two applications are necessary; usually the first of these should be made in August or September, and the second a few weeks later.

Prizer (J. A.). **Nursery Fumigation.**—*Mthly. Bull. State Comm. Hortic., Sacramento,* iv, no. 7, July 1915, pp. 303–305, 1 fig.

For dealing with a black-scale infestation in a citrus nursery, 44-foot tents were used on sectional frames made to support one of these tents and so constructed as to permit of easy movement through the nursery. The cost of each frame was about 16*s.* Two men could handle 3 tents in an hour and do the work carefully, the cost of labour per hour being about 3*s.* A 16-ounce dose was used in each tent, so that the cost of material per three tents was 3*s.* 9*d.* The total cost per three tents for one hour was therefore 6*s.* 9*d.* and as 420 trees were covered, at the rate of 140 per tent, the cost per tree is less than a farthing. Ten thousand trees were treated in spring and the results were entirely satisfactory. An increased dose would have caused serious scorching in the locality where the work was performed, but even if two fumigations were needed, as might be the case with red or purple scale, the cost would not be prohibitive.

Hall (H. V. M.). **Another Fortunate Find.**—*Mthly. Bull. State Comm. Hortic., Sacramento,* iv, no. 7, July 1915, pp. 314–315.

In May 1915, the author found among parcels in the post brought for inspection, a package from Mexico containing a quantity of guavas,

one of the favourite host-fruits of the Mexican orange maggot [*Anastrepha ludens*, Lw.]. Thirty-two living pupae of this pest were taken from the package, but no broken pupal cases, so that it was certain that none of the flies had emerged. Had it not been for the quarantine restriction, these pupae, alive and ready to emerge, would have reached Pasadena, the heart of the Californian citrus district, and being loose outside the guavas, would probably have escaped the notice of the recipient.

COOK (A. J). **Uniform Horticultural Laws.**—*Mthly. Bull. State Comm. Hortic., Sacramento,* iv, no. 7, July 1915, pp. 318–320.

Pursuant to the enactment of Assembly Bill 1211 in relation to the establishment of quarantine against infectious plant diseases, the author—as State Commissioner of Horticulture—has prepared an order, one of the sections of which aims at impeding the spread of the potato pests, *Heterodera radicicola* (eel worm), *Phthorimea operculella* (tuber moth) and of various fungus diseases of the potato.

QUAYLE (H. J.) & TYLOR (A. R.). **The Use of the Fungus *Isaria* for the Control of the Black Scale.**—*Mthly. Bull. State Comm. Hortic., Sacramento,* iv, no. 7, July 1915, pp. 333–338, 2 figs.

On account of the interest manifested by some citrus growers in the supposed effectiveness of the fungus, *Isaria*, in controlling *Saissetia oleae* (the black scale), the Citrus Experiment Station at Riverside undertook tests with this fungus. The results of the tests, as well as general observations made on this fungus since 1908, do not justify the authors in offering any hope that it will keep the citrus trees free from this pest. According to the report of the committee appointed to investigate the artificial control of the black scale by fungi in Los Angeles county, no difference between the treated and the untreated trees was noted.

SMITH (H. S.), **The Occurrence of the European Boxwood Leaf-Miner in California.**—*Mthly. Bull. State Comm. Hortic., Sacramento,* iv, no. 7, July 1915, pp. 340–343, 1 fig.

The Dipterous leaf-miner found on boxwood in a greenhouse at Fresno [see this *Review*, Ser. A, iii, p. 494] has been identified by Dr. E. P. Felt as *Monarthropalpus buxi*, Lab., the European boxwood leaf-miner, which has already become well established on Long Island and is seriously damaging boxwood hedges there [see this *Review*, Ser. A, iii, p. 459.] In California only imported plants have been attacked. Fumigation as recommended by Dr. Felt [see this *Review*, Ser. A, iii, p. 350], is the control measure advised, though hedges are rather difficult to treat in this manner.

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SERIES A: AGRICULTURAL.

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Essig (E. O.). **The Ontario Mealy Bug** (*Pseudococcus* **sp.**)—*Mthly. Bull. State Comm. Hortic., Sacramento,* iv, no. 7, July 1915, pp. 343–344, 1 fig.

The mealy bug infesting the citrus orchards at Uplands and generally known as the "Ontario mealy bug" was first believed to be *Pseudococcus bakeri*, Essig, and was reported as such by the author in January in the report to the Mealy Bug Convention at Ontario, California. Since then he has formed the opinion that it is either a new species or an imported species from some other country. In April, an infestation was discovered on *Laurus nobilis* (bay) from Holland in a Japanese nursery in Oakland and this would also indicate that the insect was imported from Holland, inasmuch as none of the plants from Japan were observed to be infested.

Insect Notes.—*Mthly. Bull. State Comm. Hortic., Sacramento,* iv, no. 7, July 1915, p. 345.

A Melolonthid, *Phobetus comatus*, Lec., has been reported as seriously injuring the foliage of cherry, plum and peach trees during the past month. A Dipterous maggot, probably the larva of *Chortophila* (*Phorbia*) *fusciceps*, Zett., was reported frequently in the spring of 1915, attacking green onions near San Francisco. *Polycaon confertus*, Lec. (olive twig borer) has been abundant in Sacramento county and has injured avocados and young citrus trees in Ventura county where a species of *Serica* is reported as doing much damage to, Ahuacate trees. The larvae of *Atherigona* sp., a fruit and vegetable infesting Anthomyid, has been intercepted in quarantine from Florida. *Trichogramma minutum*, Riley (*pretiosa*, Riley), has been reared from the eggs of the codling moth during the past month. Adults of the Galerucid, *Luperodes bivittatus*, Lec., have been riddling the leaves of the young peach trees in Sacramento county. *Serica alternata*, Lec., has been common in Ventura county and has damaged the foliage of fruit trees to some extent. *Limonius californicus*, Mann. (California wire worm), is damaging truck crops near Sacramento. The cutworm, *Agrotis ypsilon*, Rott., was so destructive to garden crops in Sacramento in the spring of 1915 that in many cases replanting was necessary. *Gastroidea cyanea*, Melsh. (green dock beetle), was very common on dock. Extensive measures have been carried out in Stockton against *Gossyparia spuria*, Mod. (*ulmi*, L.). Rosebuds are suffering much damage from the attack of *Rhynchites bicolor*, F. (rose snout-beetle). *Hoplia pubicollis*, Lec., was collected in great quantities in Placer county. About one hundred pounds weight of *Hippodamia convergens*, Guér., was collected in the high Sierras during mid-June.

Maskew (F.). **Quarantine Division: Report for the Months of April and May 1915.**—*Mthly. Bull. State Comm. Hortic., Sacramento,* iv, no. 7, July 1915, pp. 346–350.

The pests intercepted in April included:—*Cylas formicarius* in sweet potatoes; *Lepidosaphes beckii*, on grapefruit, oranges and limes; *Parlatoria pergandii* on grapefruit; *Phomopsis citri* on grapefruit; *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples; *Chrysomphalus aonidum* on green coconuts and oranges; *Coccus*

longulus on betel leaves; *Aulacaspis pentagona* on *Prunus*; *Lepidosaphes crawii* on an unknown plant; *Parlatoria theae* on a cherry tree; *Aleurodes citri* and *Ceroplastes ceriferus* on gardenia; *Aspidiotus hartii* on tuberous roots; *Lepidosaphes gloveri* on limes; *Diaspis boisduvalii* on orchids; *Calandra oryzae* in maize; *Pseudococcus citri* on ferns; *P. longispinus*, *Saissetia hemisphaerica* and *Hemichionaspis aspidistrae* on ferns and palms; *Howardia biclavis* on a branch of a coffee tree; *Aspidiotus cyanophylli* and *A. cydoniae* on bananas; *Aulacaspis rosae* on roses; *Lepidosaphes newsteadi* on umbrella pines; *Chloridea (Heliothis) obsoleta* in tomatoes; *Aphis persicae-niger* on peach; *Hemichionaspis minor* and *Thyridopteryx ephemeraeformis* on orchids.

Among the pests intercepted in May were:—*Cryptorrhynchus mangiferae* in mango seed; *Aspidiotus hartii* on yams; *Eriosoma lanigerum* on apple trees; *Saissetia oleae* on *Cyanophyllum magnificum*; *Morganella maskelli* on oranges; *Aspidiotus cyanophylli* on bananas; *Aspidiotus perniciosus* on deciduous trees; *Ceroplastes floridensis* on *Eugenia*; *Coccus hesperidum* on *Aralia* and *Ixora*; *Saissetia hemisphaerica* on *Ixora*; *Aspidiotus cydoniae* on *Asparagus madagascarensis*; *Cerataphis lataniae* on palms; living pupae of *Anastrepha ludens* in a package of guavas [see the *Review*, Ser. A. iii., p. 623].

Ballou (H. A.). **Pests of Peas and Beans.**—*Agric. News, Barbados*, xiv, no. 344, 3rd July 1915, p. 218, 2 figs.

Naphthalene possesses advantages over carbon bisulphide in protecting stored seed against attack by such insects as *Bruchus chinensis* (cowpea weevil) and *B. quadrimaculatus* (four-spotted bean weevil), as it can be used repeatedly and is not explosive. It has been found to be satisfactory when used at the rate of 1 lb. to 40 bushels of grain. In this case it was used in cloth bags, each containing $\frac{1}{4}$ lb. It seems probable that, when used at several times that strength, such as 1 lb. or more to each bushel of grain confined in tight receptacles for a few days, the insects in peas and beans would be killed, and the injury which occurs after the grain is stored would thus be entirely prevented. While 1 lb. of naphthalene to 40 bushels of grain is satisfactory for preventive purposes, the larger dose of 1 lb. to 1 bushel, with the naphthalene in 1 lb. lots, should be tried. Experiments would soon show how effective this treatment would be, and also the length of time necessary to accomplish the desired object. At the end of this period, the large bags of naphthalene could be replaced by the small ones.

A species of *Cryptorrhynchus* similar to, but slightly smaller than, that recently reported as attacking cassava [see this *Review*, Ser. A, iii, p. 504], is reported from St. Vincent, where it attacked the stems of pole Lima beans planted from imported seed. This species has not yet been investigated.

Dupont (P. R.). **Report on the Black Ants Pest in Seychelles.**—*M.S. Report to the Governor of Seychelles, dated 17th June 1915.*[Received 3rd August 1915.]

A small black ant, *Technomyrmex albipes*, Smith, became a pest in Seychelles in 1906, after two years drought. These ants live in association

with scale-insects and when these are killed by fungus parasites in wet years, the number of ants diminishes. The staple crops of the Colony (coconut and vanilla) are not seriously affected. Carbon bisulphide cannot be used for the destruction of the ants in trap boxes owing to the difficulty of importing such a dangerous substance, or of producing it on the spot in the absence of iron pyrites. Broad bands of sticky substances are being used with success. The following measures are advocated: burning all dead leaves and branches which harbour nests of ants the whole year round, and clearing weeds from the coconut plantations, with the exception of lawn grass, which by the network of its roots and stems seems to form a natural obstacle to the journeys of the ants from one part of the field to another.

PIERCE (W. D.). **Some Sugar-Cane Root-Boring Weevils of the West Indies.**—*Jl. Agric. Research, Washington, D.C.*, iv, no. 3, June 1915, pp. 255–263, 4 plates.

The genus *Diaprepes*, popularly known as sugar-cane root-borers, is one of the most important groups of economic weevils in the West Indies; it is mainly confined to the periphery of the Caribbean Sea. Some of the species exhibit local variations in the different islands, and the author treats the following forms as merely local races of *D. spengleri*, L. *D. spengleri marginatus*, Ol., is only recorded from St. Croix; *D. spengleri comma*, Boh., ranges from the Dominican Republic and Porto Rico to Dominica; typical examples of *D. spengleri*, L., are only found in Porto Rico; *D. spengleri abbreviatus*, L., occurs in Porto Rico, Montserrat, Dominica and Barbados; *D. spengleri denudatus*, var. n., has been obtained only from Guadeloupe; *D. spengleri festivus*, F., occurs in Barbados and St. Vincent. *D. famelicus*, Ol., of which *D. esuriens*, Gyll. is treated as a synonym by the author, occurs in Montserrat, Dominica and St. Kitts, where it attacks sugar-cane.

[It is to be regretted that the author has adopted the name *D. spengleri* for the destructive root-borer of sugar-cane, seeing that *D. abbreviatus*, L., is not only the older and therefore more correct name, but is also already in general use in the West Indies. The name *abbreviatus* should therefore be substituted for *spengleri* in all the foregoing trinomials, while *spengleri* itself should stand as *D. abbreviatus spengleri*. *D. esuriens* cannot properly be treated as identical with *D. famelicus* (from Guadeloupe), being probably a local race of that species.—Ed.]

WADSWORTH (J. T.). **Notes on some Hymenopterous Parasites bred from the Pupae of *Chortophila brassicae*, Bouché, and *Acidia heraclei*, L.**—*Ann. App. Biol., London*, ii, nos. 2 & 3, July 1915, pp. 158–161.

The following parasites are recorded as having been reared from the pupae of *C. brassicae*: The Ichneumons, *Phygadeuon fumator*, Grav., and *Atractodes tenebricosus*, Grav. (*vestalis*, Hal.) and the Cynipid, *Cothonaspis* (*Eucoila*) *rapae*, Westw.; from the pupae of *Acidia heraclei* (celery fly): the Ichneumon, *Hemiteles crassicornis*, Grav. (= ? *subzonatus*, (Grav.) and the Braconid, *Adelura apii*, Curtis. The first four species do not appear to have been previously recorded from these Dipterous hosts.

Breeding-cages for Insects.—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta,* part 2, 1915, pp. 47–48, 2 plates.

Two simple breeding-cages for insects are described. The first type is useful for rearing leaf-eating caterpillars and is made from an ordinary cylindrical lamp-chimney, provided with a wire gauze cap at each end. Any size chimney may be used, but one about 10 inches long with a diameter of $2\frac{1}{2}$ inches is most generally useful. To make the cap a strip of thin metal $\frac{1}{2}$ inch wide is bent into a ring which just fits over the cylinder, and the end is soldered. A piece of wire gauze is then soldered across the opening of the ring, and a small strip of thin metal, about $1\frac{1}{2}$ inch long and $\frac{3}{8}$ inch wide, is soldered by one end to the inside of the ring to act as a spring, which clips the cylinder firmly and keeps the cap from falling off. A piece of hoop iron is bent so as to form a stand on which the cylinder may be laid horizontally.

The second type of cage is primarily designed for rearing sucking insects on small plants. It is made from a large and wide pear-shaped lamp-chimney or globe, such as that of a hurricane lantern, which rests in a metal socket. This socket consists of two cylinders of sheet metal of equal diameter, each about 2 inches long, joined end to end by a strip of wire gauze bent into a ring of the same diameter as the cylinders. The top of the glass globe is closed by a gauze cap or by muslin. This cage is placed over the plant and the bottom rim of the metal cylinder is pressed about 1 inch into the soil.

Gibson (A.). **Cutworms and their Control.**—*Dominion of Canada Dept. Agric., Entom. Branch, Ottawa,* Bull. no. 10, 1915, 31 pp., 20 figs. [Received 11th August 1915.]

Injury by cutworms is mostly effected in the spring and usually ceases before the end of June. *Euxoa ochrogaster* (red-backed cutworm) is found throughout Canada, attacking all kinds of garden and field crops. In Ottawa, this species passes the winter in the egg-stage. Eggs deposited in October hatched on 20th April; the larvae pupated on 10th June and the adults began to emerge on 20th July. In Manitoba, larvae pupated on 24th and 27th June and adults emerged on 15th July. In most seasons the larvae become full-grown in the latter half of June. *Agrotis ypsilon* is especially destructive to garden crops. In eastern Ontario larvae were numerous in the latter half of May and during the first week of June. There are probably two generations annually, adults having been collected in Ontario on 16th May and 25th October. Larvae collected in July entered the earth to pupate on the 17th, and adults emerged on 7th August. *Lycophotia margaritosa* (*Peridroma saucia*), variegated cutworm, occurs periodically in destructive numbers. There is no limit to the host plants. There are probably two broods annually in Canada, the moths appearing in June and again after the middle of August. The species may hibernate in the pupal or adult state. *Euxoa messoria*, which attacks vegetables, flowers, small trees and shrubs, was very prevalent in 1914 in Ontario and Quebec. Adults have been found in August and September. *Lycophotia* (*E.*) *scandens* is often responsible

for serious losses on account of its habit of climbing fruit trees and destroying the buds. Such injury is done in May and early June. The species occurs from Manitoba to the Maritime Provinces. The moths appear in June and July. In eastern Ontario, the insect hibernates as an immature larva. *Agrotis unicolor* (*Noctua clandestina*) attacks vegetables, fruit trees, shrubs and the roots of grasses. The moths fly from June to September. The immature larvae hibernate in the soil at a short distance below the surface. In the spring they become active, becoming full-grown in May or June. Adults collected in the middle of October may have belonged to a second brood. *Agrotis* (*Noctua*) *c-nigrum* has been recorded on tomatoes, carrots, gooseberry, etc. The over-wintering larvae come out of hibernation as soon as food is available, and produce moths in May or June. *Hadena devastatrix* seldom comes above the surface of the ground, but feeds on the roots and underground stems of grasses, wheat, oats, etc. In Ottawa the larvae have been found on young tobacco plants. Adults are found from June to September. Eggs are laid late in the season and the larvae hibernate when partly grown. Larvae found in Ontario in May pupated on 19th May and the adults emerged on 19th July. *Parastichtis* (*H.*) *arctica* is similar in habits to *H. devastatrix*, and is most abundant in May and June. *Scotogramma* (*Mamestra*) *trifolii* is usually abundant in Ontario during August, when pea fields are attacked. The outer portion of the pods, as well as leaves and parts of the stems, are eaten. When food becomes scarce, this species assumes the marching habit. In Ontario and the eastern provinces, adults have been collected from May until autumn, so that there are probably at least two broods. Larvae of *Feltia ducens* have been found in spring and in September. In eastern Canada moths are abundant in August and in western Canada about a month earlier. *Agrotis* (*Noctua*) *fennica* chiefly attacks leguminous crops, and is most abundant in Ontario and Quebec. The larvae become full-grown and disappear in most years about the end of May. *Nephelodes emmedonia* is injurious to grass lands in Eastern Canada. The larvae are met with from April to June; eggs are laid in late summer or autumn and the winter is passed in the larval stage. *Euxoa tessellata* (*declarata*) caused serious loss in vegetable gardens in Manitoba, Ontario, Quebec, and Prince Edward Island during June 1914. There is apparently one brood annually; in Ontario, pupation occurred from 23rd to 27th June, and adults emerged from 11th to 16th July. *Porosagrotis orthogonia* was not known as an injurious insect until 1911. In that year extensive damage to grain crops was reported from Alberta. In Ottawa, larvae pupated in the soil on 28th May, and adults emerged on 19th July. In Alberta and Saskatchewan *Euxoa* (*Chorizagrotis*) *auxiliaris* (*introferens*) and *E. agrestis* have been recorded on many kinds of succulent plants. The larvae of *Euxoa excellens* and *Hadena* (*Dargida*) *procincta* have been found on vegetable crops in British Columbia. In Manitoba, larvae of *Euxoa detersa* (*personata*) and *Feltia venerabilis* have destroyed vegetables, and in 1914, the latter species was found on oats. [For methods of control see this *Review* Ser. A, ii, pp. 24 and 521; iii, pp. 564 and 620.]

CRIDDLE (N.). **The Hessian Fly and the Western Wheat-Stem Saw-Fly in Manitoba, Saskatchewan and Alberta.**—*Dominion of Canada Dept. Agric., Entom. branch, Ottawa,* Bull. 11, 1915, 23 pp., 4 figs. [Received 11th August 1915.]

The attacks of *Mayetiola destructor* (Hessian fly) are usually confined to wheat, rye and barley, although spelt and *Agropyron tenerum* are probably also infested. The life-history differs considerably according to the latitude and geographical conditions under which it occurs. In Manitoba there is one full brood, with a supplementary summer brood averaging about 20 per cent. of the spring brood. Flies emerge from over-wintering pupae about 15th May, and continue to appear until the end of that month. Eggs are deposited almost immediately after emergence, being usually placed on the upper surface of the leaves. The larvae, which hatch in from 10 to 12 days, work their way down between the sheaths towards the roots. The main shoot is ultimately killed. Puparia occur in the second half of June among the dead leaves at the base of the plant. From about 20 per cent. of the spring brood adults begin to emerge at the end of June, increasing in numbers until about 10th July, after which they gradually diminish. Eggs from these adults are deposited on leaves above the second joint; puparia are present late in July and the winter is passed in this stage. Flies emerging late in July or August, deposit eggs on late barley and self-sown wheat. Young plants attacked in spring show at first a bluish tint, while the central shoot is stunted; later they become yellow at the tips and either die outright or survive by throwing out new lateral shoots. Control measures consist of: (1) ploughing all infested stubble between 15th August and the middle of the following May; (2) burning stubble and straw piles between the same dates; (3) sowing strips of grain about 20 feet wide between infested stubble and newly planted grain to attract flies on occasions of severe outbreak. The strips should be planted early and ploughed down about the middle of June. Excess of rainfall combined with warmth, particularly in early summer, favours development of the insect, while dryness has the opposite effect. Hymenopterous parasites are important in checking the pest. Early maturing wheat would probably suffer less than late-ripening varieties.

Cephus occidentalis (western wheat-stem saw-fly) has gradually spread from wild grasses of the genus *Agropyron* to cultivated grain crops, including wheat, rye, spelt and barley. Adults begin to appear about the second week in June. Eggs are deposited at the end of June, usually above the topmost joint, either between the sheath and the stem or inside the stem. The larvae hatch in three or four days, and gradually pass down to the lowest joint. The stem is gnawed through from the inside, and in the basal part the larva constructs a cocoon in which it remains until the following May. Pupation then occurs and the adult emerges in June. The only means of distribution are by flight or by artificial carriage in the adult stage. Dispersal by flight does not amount to more than a few miles annually. All infested stubble should be ploughed not less than 5 inches deep between 1st August and the end of the following May. Infested grasses, such as western rye grass, timothy and prairie grasses, near growing crops, should be cut between 10th July and 1st August. By this means,

the larvae will be caught in the straw before they reach the ground. When a small area is under cultivation the sowing of oats or root crops would either kill the insect or cause it to return to wild grasses. Natural enemies appear to be very few, the pest being controlled more by the supply of food than by parasites. An undescribed Chalcid has however been reared from the larva.

PATCH (Edith M.). **The Pond-Lily Aphid as a Plum Pest.**—*Science, Philadelphia,* xlii, no. 1074, 30th July 1915, p. 164.

Rhopalosiphum nymphaeae, L., a well-known pest of water plants, also attacks the plum, living on the shoots and ventral surfaces of the leaves. Usually, no deformation of the leaf results, but there is a tendency to feed also on the young fruit. The spring migrants from the plum pass to *Alisma plantago-aquatica* (water-plantain), *Sagittaria latifolia* (arrow-head), and *Typha latifolia* (bulrush). Return to the plum for the deposition of over-wintering eggs takes place in autumn. This species has possibly been recorded under a more recent name as a European plum pest [see below p. 639].

HOOD (J. D.) & WILLIAMS (C. B.). **New Thysanoptera from Florida and Louisiana.**—*Jl. New York Entom. Soc., Lancaster, Pa,* xxiii, no. 2. June 1915, pp. 121–133, 4 plates.

The following new genera and species of Thysanoptera were collected during November and December 1914 in Florida and Louisiana: *Bregmatothrips gracilis*, sp. n., found on grass: *Merothrips fusciceps*, sp. n., from Oriental bamboos; *Haplothrips* (?) *bellis*, sp. n., from grass and rushes; *Zygothrips bicolor*, sp. n., taken on an undetermined plant, possibly *Mimosa*, from Spanish moss on pine and from bamboo and rushes; *Z. pullus*, sp. n., from bamboo, sago palm and live oak covered with Spanish moss; *Trichothrips marginalis*, sp. n., from under the bark of willow; *T. terminalis*, sp. n., from the stump of an undetermined tree in a damp situation; *Symphyothrips punctatus*, gen. et sp. n., from an orange tree; *Gnophothrips megaceps*, gen. et sp. n., from a tree stump; *Barythrips sculpticauda*, gen. et sp. n., from a pine stump and *Polyphemothrips tibialis*, sp. n., from privet.

Destrucción de Plagas. [Pest destruction.]—*Bol. Minist. Agric., Buenos Aires,* xix, no. 3–4, March-April 1915, pp. 141-143. [Received 24th August 1915.]

In February 1915, 31,797,762 kilos of locusts were destroyed in the Argentine, including 31,755,157 kilos of hoppers, no eggs being destroyed. In March, the total amounted to 651,880 kilos, including 17,480 kilos of eggs, no winged individuals being destroyed. The total number of ant-hills destroyed in February amounted to 976, the corresponding figure for March being 2,302.

LEEFMANS (S.). **De Cassave-Mijt.** [The Cassava Mite.]—*Meded. van het Laboratorium voor Plantenziekten, no. 14, Dept. van Landbouw, Nijverheid en Handel, Buitenzorg,* 1915, 35 pp., 3 plates.

In 1906 the cassava mite was reported from a large cassava estate in East Java on the slopes of the volcano, Kloet. According to Dr. P. J. S. Cramer, of the Department of Agriculture, this *Tetranychus* is distinct from both *T. exsiccator*, Zehntner, the sugar-cane mite, and *T. bioculatus*, Wood Mason, the tea mite. Planting another crop, on which red spider could not live, to alternate with cassava, and thus limit the spread of the pest, was advised, but technical reasons prevented this recommendation from being followed. For a long time nothing was done but stripping the leaves of the plants attacked. In 1912 the question was taken up again. The damage caused is very characteristic. Yellow spots appear on the leaf near the stem, and the leaf ultimately becomes entirely yellow and drops. The mites live under the leaves and are rarely, if ever, found on the upper surface. The cassava mite is a dry monsoon pest. A long dry period, heavy winds and the effects of the mite unite to make the leaves drop over large areas, causing considerable losses, especially as the plants, after being attacked repeatedly, often die. During the rains, the cassava mite causes no damage of any importance, though not entirely absent.

The author considers the species concerned to be *Tetranychus bimaculatus*, Harvey. The pale yellow eggs are laid on the underside of the leaves, generally near the veins. They hatch after four or five days. The freshly emerged spider-mites are pale yellow ; they reach maturity in 10 or 11 days. *T. bimaculatus*, Harvey, is now found in Java on cassava, *Ricinus communis*, *Cinchona* and *Clitoria* and on many weeds and grasses. Immune varieties of the sweet cassava are unknown there. Experiments proved that the mites spread principally by travelling from plant to plant and are assisted by the wind, especially when attacked leaves, bearing many mites and their eggs, drop to the ground and are blown away. Dispersal may also be assisted by the labourers, who convey the mites in their clothing. Natural enemies include Coccinellids and a predaceous yellow mite, the latter probably not being of importance. Experiments were tried in conveying beneficial Coccinellids from the rice fields, where they occurred in great numbers, to the cassava, but they could not be induced to remain there. About 50 insecticides were tried. The best was lime-sulphur, 5 per cent., 28° Bé., to which 1 litre of potash resin soap was added for every 15 litres of lime-sulphur (1 litre of potash resin soap was made by boiling 33 grms. resin and 5 grms. caustic potash in 1 litre of water). This insecticide killed all the mites which it touched, as well as 97·4 per cent. of the eggs. Lack of water however prevented its use on a large scale, and it is also rather expensive. Small experiments with finely powdered sulphur gave favourable results, but on a bigger scale it was not satisfactory, as one month after the application the plants were again rather badly attacked. The only method giving generally good results, if applied in time, is the stripping and burning of the attacked leaves. This method involves, however, considerable loss and is therefore only advisable for small areas in order to prevent the spread of the pest. The long dry periods in the locality in question specially favour this pest, and better watered areas with a regular rainfall should be chosen for cassava culture.

Theobald (F. V.). **Additions to the list of Kent Aphididae.**—*Entomologist, London,* no. 627, August 1915, pp. 182–184.

The following Aphids were collected in Kent in 1914–15:—*Macrosiphum fragariae,* Koch, on the leaves and stalks of strawberry; *Macrosiphoniella chrysanthemi,* Del Guercio, on outdoor and greenhouse chrysanthemums; *Aphis urticaria,* Kalt., on *Urtica* and *Parietaria officinalis*; *A. adjecta,* Walk., on *Cynoglossum officinale*; *A. infuscata,* Koch, on *Prunus spinosus*; *A. helichrysi,* Kalt., on *Achillea millefolium* (yarrow); *A. anthrisci,* Kalt., on *Anthriscus* sp.; *A. sedi,* Kalt., on *Sedum acre* (yellow stonecrop); *A. chrysanthemi,* Walk., on *Chrysanthemum leucanthemum* (ox-eye daisy); *A. scabiosae,* Kalt.; *A. galii,* Kalt., on *Galium cruciata*; *Callipterus platani,* Kalt., on sycamore, attended by the ant *Lasius fuliginosus*; *Chaitophorus betulae,* Buckt., on birch; *Pachypappa reaumuri,* Kalt., on *Tilia* spp.; *Pemphigus piceae,* Hartig, on the roots of *Picea excelsa* and the Sitka spruce; this species also attacks *Pinus* and *Larix*; *Prociphilus nidificus,* Lw., forming leaf-galls on ash; *P. bumelia,* Schrank, from leaf-stalks of ash; *Lachnus fasciatus,* Burm., on *Picea excelsa*; *Rhizobius pini,* Burm., on roots of *Pinus*; and *R. viridis,* sp. n., on roots of spruce.

Girault (A. A.). **Four new Encyrtids from Sicily and the Philippines.**—*Entomologist, London,* no. 627, August 1915, pp. 184–186.

The following new species are described:—*Paraleptomastix abnormis* and *Epidinocarsis pseudococci,* reared from *Pseudococcus citri* from Sicily, and *Neanastatus orientalis* and *N. philippinensis,* from Manila.

Pliginsky (V. G.). **Вредители коллекцiй и борьба съ ними.** [Pests of collections and their control.]—**«Бюллетени Харьковскаго Общества Любителей Природы.»** [*Bulletins of the Charkov Society of Friends of Nature*], *Charkov,* 1915, no. 3, pp. 73–76, 6 figs.

Besides the well known *Tinea pellionella,* L., zoological collections are injured by the larvae of *Anthrenus verbasci* in the south of Russia, by those of *A. museorum,* L., in the North, also by *Dermestes lardarius,* L., and *Attagenus piceus,* Oliv., and by some Pseudoneuroptera, of which the most widespread species is *Troctes divinatoria,* Mull.; ants also injure collections, as well as termites in Turkestan. Disinfection by fumigation with carbon bisulphide or naphthalene and also with a mixture of camphor and naphthalene are recommended against these pests. The author's method of preparing this mixture is as follows: 4 lb. of naphthalene and ½ lb. or more of camphor are melted on a slow fire, care being taken to prevent the naphthalene from igniting; the mixture is then poured into moulds, formed of a potato with a hole bored through it, both ends of the potato being cut away, and a slice serving as a bottom. When the melted mixture has cooled down, the small cylindrical bars, so formed, can be pressed out of the mould, which can be used again.

SOPOTZKO (A.). **Отчетъ о дѣятельности Станціи за 1913 и 1914 годъ.** [Report on the work of the Station for 1913 and 1914.] Published by the Entomological Station of the Zemstvo of the govt. of Tula, *Tula*, 1915, 29 pp.

This report covers a period of two years, the weather conditions of which were widely different. *Euxoa segetum*, Schiff., occurred in 1914 in large numbers in several districts. Observations during the last five years have shown that the time of the appearance of the imago in spring is fairly constant, varying between the 3rd and 9th May. The time of the disappearance of the moths of the first generation and the appearance of the second generation was very different in 1914 as compared with the previous four years; the moths of the first generation came to an end in 1914 on 12th July, some 10 to 14 days earlier, and the second generation appeared on 28th July, or about three weeks earlier. The causes of this are to be found in the dry weather and high temperature which prevailed in 1914. A table summarising the results of observations during the last five years shows that the number of the imagines attains its maximum before the 4th July; it is therefore important to keep fallow fields clean at that time. The numbers of the second generation are usually much less than those of the first.

Hydroecia nictitans, L., did considerable damage in 1914, principally to oats, about one-third of the harvest in one district being destroyed. The damage was observed from the first half of June onwards. The plants were withered and yellow and had a large hole in the lower part of the stem. Having left the stem, the caterpillars inhabit the upper layer of the soil, whence they attack the plants at night. Injury was chiefly noticeable near the boundaries of fields. In 1910 and 1911 the numbers of *H. nictitans* on the wing were small; in 1912 they formed 13·1 per cent. of moths caught in molasses troughs; in 1913 this figure rose to 20·7 per cent., and in 1914 to 46·8 per cent. in one district, to 69·1 per cent. in another, and to 83·4 per cent. in a third. In 1914 the imagines were on the wing on the 12th July, a month earlier than usual. There is no doubt that this insect winters in the egg-stage. The eggs are laid in lines on weeds and grasses, on self-sown oats and especially on rye stubbles, on which they are deposited between the stem and the remnants of the leaf-sheath. The following measures against this pest are recommended :—Ploughing the stubbles to a depth of about 7 inches to destroy the eggs and the newly hatched larvae, the making of furrows to form boundaries to the field, and the use of molasses troughs in July and August.

The weather conditions of both 1913 and 1914 largely affected various species of *Apion*. Owing to the early spring of 1913, the weevils appeared early in April, but on the 30th April very cold weather was experienced, which interfered with the growth of most plants, including clover. The females began to oviposit very early, on 19th May, but owing to the absence of heads of clover and to the small number of flower buds at that time, the eggs had to be laid in the buds of leaves, where the larvae perished: only the larvae from eggs laid a month later were able to develop. The first pupae were therefore found a month later than in 1911 and 1912, viz., in the second half of July, and thus the number of this pest was considerably diminished.

The dry weather of 1914 again affected these weevils in the same way and it is not expected that this pest will be serious in 1915. The various species were caught in the following proportions by means of nets :—*Apion apricans*, 55·7 per cent. ; *A. aestivum* (*trifolii*), 36·6 per cent ; *A. varipes*, 4·8 per cent. ; *A. flavipes*, 1·9 per cent. ; *A. seniculus*, 0·8 per cent. ; *A. frumentarium*, 0·1 per cent. ; *A. viciae*, 0·1 per cent.

Trachea (*Hadena*) *basilinea*, F., injured rye and wheat in some parts of the government in 1913 ; the number of moths caught in molasses troughs amounted to about 50 per cent. of the whole. They were chiefly on the wing during the second half of May and the first half of June. No complaints of this pest reached the station in 1914, and only small numbers were noticed during June. *Feltia* (*Agrotis*) *exclamationis*, L., is usually found together with *Euxoa segetum*, but in considerably smaller numbers ; thus in 1910 there were caught in molasses troughs in one district 86·5 per cent. of the latter and 2·8 per cent. of the former ; in 1911 the figures were : 45·5 per cent. and 8 per cent. ; in 1912, 48·6 per cent. and 8·2 ; in 1913, 77·1 per cent. and 9 per cent., and in 1914, 41·6 per cent. and 21·5 per cent. In 1914 the numbers of *F. exclamationis* caught were in some localities nearly equal to those of *E. segetum*. The two species appear about the same time, and though the flight of *F. exclamationis* lasts longer, the molasses troughs used for *E. segetum* will also prove effective against it.

Общіе выводы объ ожидаемомъ урожаѣ хлѣбовъ и о сборѣ сѣна въ Европейской Россіи, въ Западной Сибири и Средне-Азіатскихъ областяхъ. [General summary of the expected harvest in European Russia, Western Siberia and Central Asia.]—**« Извѣстія Глав. Управ. З. и З.»** [*Bulletins of the Central Board of Land Administration and Agriculture*], *Petrograd*, no. 30, 8th August 1915, pp. 747–753.

The following insect pests are reported from various parts of Russia. The Hessian fly [*Mayetiola destructor*] was observed both on winter and summer sown wheat and on barley in Central Russia and along the Volga. *Anisoplia austriaca* appeared in large numbers in Central Russia, in Novorossia (South Russia) and in the government of Kiev, but owing to the rapid ripening of the crops, it did damage for brief periods only. *Oscinella frit* was reported from Saratov, Voronezh and elsewhere in the south-west on barley and oats. *Phlyctaenodes* (*Botys*) *sticticalis* injured beet and vegetables in Poltava and Kiev, while peas in some localities on the Volga and in Tambov, Kiev and Ekaterinoslav suffered from Aphids. *Haltica* sp. did considerable damage in June and July to beets, linseed and vegetables. Thrips in Voronezh and *Oria* (*Tapinostola*) *musculosa* in the province of Don, were only present sporadically. Locusts appeared in the steppe provinces of Siberia and also in the governments of Tomsk and Enisseisk, but over limited areas and did not do much damage.

MORITZ (L.). **Біологическія наблюденія надъ саранчевыми въ Тургайской области.** [Biological observations on Locusts in the province of Turgai.]—**«Любитель Природы.»** [*Friend of Nature*], *Petrograd*, nos. 2 and 3, February–March 1915, pp. 33–47 and 65–76, 9 figs., 2 plates.

The author was deputed by the Department of Agriculture in 1914 to study the locusts in the province of Turgai. The species found included :—*Stenobothrus nigromaculatus*, H.-S., *S. fischeri*, Eversm., *Omocestus ventralis*, Zett. (*S. rufipes*, Fisch.), *Omocestus* (*S.*) *haemorrhoidalis*, Charp., *Stauroderus* (*Stenobothrus*) *biguttulus*, L., *Chorthippus* (*S.*) *pulvinatus*, F.-W., *C. albomarginatus*, Deg. (*elegans*, Charp.), and *C. dorsatus*, Zett. The life-history of these species is much alike ; they begin to hatch out in May, the first winged specimens appearing in the first half of June. They are chiefly found in meadows and feed on grain crops, being very injurious in some years. They gradually disappear after the middle of August. The genus *Gomphocerus* is represented in Turgai only by *G. antennatus*, Fieb., and *G. pallidus*, Brunn. As regards *Dociostaurus* (*Stauronotus*) *kraussi*, Ingen., and *D. brevicollis*, Eversm., the latter hatches in the second half of May, the first winged specimens appearing in the middle of June. Oviposition takes place at the end of June. Both these species frequent uncultivated land with a clay soil. About 12 per cent. were infested with larvae of a species of *Sarcophaga*. *Pallasiella* (*Stethophyma*) *turcomana*, Fisch., and *Arcyptera* (*S.*) *flavicosta*, Fisch., were also present. The latter hatched in the first half of May and the winged insects appeared a month later ; its egg-clusters were found in meadows, and along small ravines in the steppes. Of 600 egg-clusters examined, 25 per cent. contained larvae of *Mylabris*, the adults of *M. 14-punctata*, Pall., being also present in some cases ; 2 per cent. were infested with the Bombyliid, *Anastoechus* (*Systoechus*) *nitidulus*, F., and 2 per cent. with some fungus disease. *Aeolopus* (*Epacromia*) *thalassinus*, F., and *A. tergestinus*, Charp., also occurred. *Pyrgodera armata*, F.-W., was common in the district of Irgiz and began to hatch in the middle of May, the first winged insects appearing a month later ; this species frequents the slopes of hills and also plains with sandy and clayey soil. *Oedaleus nigrofasciatus*, De Geer, which began to hatch in the first half of June, usually lives on the southern slopes of hills, with a scanty and sun-burned vegetation. The biology of *Locusta* (*Pachytylus*) *migratoria*, L., and *Calliptamus italicus*, in this region, has already been dealt with [see this *Review*, Series A, iii, pp. 536, 603, 610]. *Celes variabilis*, Pall., which hatched during the latter half of May, lives in dry places with scanty vegetation and feeds on weeds. *Oedipoda salino*, Pall., only occurred in small numbers ; *O. coerulescens*, L., hatched in the first half of June ; the first winged specimens appeared a month later and disappeared in the first half of September ; they remain in open places and feed mostly on wormwood ; short migrations of the winged insects were noticed. *Bryodema tuberculatum*, F., which began to hatch in the middle of May, lives in dry, elevated places, and in years of outbreaks, causes injury to meadows. About 8 per cent. were infested with a species of *Sarcophaga*. Other locusts present were *Sphingonotus callosus*, Fieb., *S. coerulans*, L., *S. nebulosus*, F.-W., *Hyalorhipis* (*Leptopternis*) *clausi*, Kitt., living on sandy soils, *Tmethis*

(*Eremobia*) *muricatus*, Pall., frequenting clayey soils with scanty vegetation, and *Podisma* (*Pezotettix*) *pedestris*, L., which hatched in the middle of May, and in years of outbreaks, injures meadows and market-garden crops.

SCHREINER (J. T.). **Насѣкомыя, вредящія горчицѣ въ Астраханской губерніи.** [Insects injurious to mustard in the govt. of Astrachan.] —**«Защита растеній отъ вредителей.»** [*The Protection of Plants from Pests.*] Supplement to **«Любитель Природы.»** [*Friend of Nature*], *Petrograd*, nos. 5 and 6, May-June 1915, 55 pp., 41 figs.

This is another report on insect pests found on mustard crops in Astrachan [see this *Review*, Ser. A, ii, p. 355], where *Sinapis juncea*, L., is principally grown. *Pieris daplidice*, L., is one of the chief pests of mustard and occurs over the whole of European Russia, in Caucasia, Siberia as far as the Western Altai, and in Russian Central Asia. About 20 per cent. of the larvae were infested with *Chalcis flavipes*, Panz., and 2 or 3 per cent. of the pupae with *Pteromalus puparum*, Sven., while the caterpillars were also attacked by *Anilasta ebenina*, Grav. As a remedy against the first generation of caterpillars, which is the most injurious, spraying with quassia emulsion or tobacco decoction when the plants are in blossom is recommended; machorka tobacco dust may be also used in small plantations, the dusting being done early in the morning. *Pieris brassicae* has not been observed by the author on mustard, but *P. rapae*, L., has been noticed in small numbers. Only the first generation of *Phytometra* (*Plusia*) *gamma*, L., is of importance to mustard crops. *Evergestis extimalis*, Scop. (*Orobena margaritalis*, Schiff.), is very injurious to mustard, though its caterpillars are much parasitised by a fly. The best remedy consists of mowing the crops and harrowing the field during the pupal stage. The first generation of *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.), breeds in Astrachan on mustard, on which it also pupates; the moths of the second generation appear in the middle of June, the caterpillars only partly living on mustard. Ploughing in autumn, destruction of weeds and spraying with the above insecticides are recommended.

Among Coleopterous pests, *Entomoscelis adonidis*, Pall., is distributed over the whole of South and South-East Russia, and also occurs in Turkestan and Southern Siberia. The larvae destroy the leaves, while the beetles feed on the pods. Spraying with urania green or djipsin before the mustard flowers, and the collection of the beetles are recommended. *Colaphus hoefti*, Ménétr., is also commonly found on mustard; this species has been mistaken for *C. sophiae*, Schall., which does not occur in Astrachan at all. Only the first generation is dangerous to mustard and the destruction of weeds and spraying with quassia emulsion and tobacco decoctions are advised. Various species of *Phyllotreta*, which are most dangerous enemies of mustard, include:— *P. atra*, F., *P. cruciferae*, Goeze, *P. diademata*, Foudr., and *P. schreineri*, Jakob [see this *Review*, Ser. A, iii, p. 439.] All these beetles winter and appear early in spring, attacking mustard especially in June. Sticky traps are the best remedy for this pest, especially

the so called Goettingen cart, which is described and figured; spraying operations are also useful, but must be carried out before flowering. *Lixus ascanii*, var. *albomarginatus*, Boh., appears in April and remains all its life on mustard; the females oviposit either in the stem or in the petioles of the leaves near the roots; the larvae hatch at the end of May and penetrate through the centre of the stem in the direction of the root. Early crops are most likely to suffer from this weevil, against which the introduction of mustard into a rotation of crops is advised. Trap crops are also recommended, to be sown in strips along the ends of the fields where mustard was grown the previous year, and to be destroyed in the first half of June. *Lixus bicolor*, Panz., occurs occasionally on mustard; its importance has not yet been investigated. *Omophlus pilicollis*, Ménétr., is found everywhere in the steppes on mustard and other plants and devours the flowers. *Podonta daghestanica*, Reitt., occurs on the lower Volga, in the Crimea and in Caucasia, and also devours the flowers, as do various Meloïd beetles, such as:- *Mylabris* (*Zonabris*) 4-*punctata*, L., *M.* 10-*punctata*, Oliv., *M.* 14-*punctata*, Pall., *M. maculata*, Oliv., *M. floralis*, Pall., *M. impar*, Thunb. (*grisescens*, Tausch.), and *Lydus syriacus*, L. All these insects are useful in destroying egg-clusters of locusts, but as the control of the latter can now be effected by other means, they should be destroyed by spraying with quassia emulsion or tobacco decoction or by dusting with tobacco, if they occur in large numbers.

Athalia spinarum, F., is the only Hymenopterous pest of mustard in Astrachan, where it appears at the end of May. Usually there are two generations, a spring and an autumn one, but in Astrachan there is probably a third. The Chalcid, *Perilampus splendidus*, Dalm., has been reared from the larvae. Destroying weeds, trap crops, spraying with djipsin, urania green or calcic arsenite, and harrowing the infested fields after removing the crop, are recommended. The Rhynchota which damage mustard, include:—*Eurydema festivum*, L., *E. ornatum*, L., *Carpocoris purpureipennis*, Deg., and *Lygaeus* (*Spilostethus*) *equestris*, L. Their importance is not great, unless they are present in large numbers.

Dobrovliansky (V. V.). **Отчетъ о работахъ Энтомологическаго Отдѣленія. Отчетъ о дѣятельности Кіевской Станціи по борьбѣ съ вредителями растеній при Южно-Русскомъ Обществѣ П. З. и С. П. за 1914 годъ.** [Report of the Entomological Section. Report on the work of the Kiev Station for the control of pests and plants of the South-Russian Agricultural Syndicate for 1914.]—**«Хозяйство.»** [*Husbandry*], *Kiev*, 1915, nos. 18, 28th May, 19, 4th June, 20, 11th June, 21, 18th June, 22, 25th June, 23–24, 9th July and 27–28, 6th August, pp. 532–539, 564–568, 594–599, 621–626, 655–660, 697–702 and 763–766: 4 figs.

This report gives details of the life-history of various insect pests. On the 8th June some winged Aphids were found on *Galium uliginosum* (swamp bed-straw). They greatly resembled winged forms of *Myzus cerasi*, F.: larvae in the first stage were also present, but the absence of both wingless forms and nymphs showed that the insects had

migrated from some other plant. Experiments on transferring winged specimens of *M. cerasi* taken from cherries to *G. uliginosum* were made, demonstrating that *M. cerasi* can migrate either to *Galium* or *Veronica*, the summer generations on these plants being known as *Myzus aparines*, Kalt. *M. cerasi* also breeds during the whole summer on cherries, without migrating, although to a somewhat restricted degree. Experiments on *Aphis prunorum*, Dobr. [see this *Review*, Series A, ii, p. 79] have shown that this species is identical with *Aphis* (*Rhopalosiphum*) *nymphaeae*, L., which breeds during the summer on various water plants. The migrations of this species in autumn to some unknown plants have already been noticed by Mordwilko.

Various TORTRICIDAE have done great damage to orchards during late years and in 1914 *Tortrix* (*Pandemis*) *ribeana*, Hb., *T. heparana*, Schiff., and *Eucosma* (*Tmetocera*) *ocellana*, F., were the most injurious; *Olethreutes variegana*, Hb., was also present. The hibernating caterpillars of *T. ribeana* were observed in the first half of April in stout cocoons in cracks and underneath the bark of small branches; the first moths appeared towards the end of May and those of the second generation in the second half of July. The life-history of *T. heparana* is similar, and it hibernates also as a caterpillar, not as a pupa, as thought by Henschel. The hibernating caterpillars of *E. ocellana* were found on 7th April on apple trees, in white silky cocoons near the base of leaf-buds; the caterpillars also injured pear, plum and cherry trees. According to some authors this insect winters in the egg-stage, but it has now been observed that hibernation occurs as a young caterpillar. From caterpillars of *Malacosoma* (*Lasiocampa*) *neustria*, L., the Tachinid, *Carcelia gnava*, Meig., and another parasite were reared. Large numbers of caterpillars of *Abraxas grossulariata*, L., perished from a fungus disease resembling flacherie, and a large percentage was also infested with various parasites, including the Tachinid, *Blepharidopsis nemea*, Meig. Caterpillars of *Euproctis chrysorrhoea*, L., were parasitised by the Tachinid, *Compsilura concinnata*, Meig.

A list of NOCTUIDAE caught in troughs with molasses is given, including *Euxoa segetum*, *Agrotis ravida*, Schiff. (*obscura*, Brahm.), *A. orbona*, Hüfn., *A. c-nigrum*, L., *Episilia* (*A.*) *simulans*, Hüfn., *Feltia* (*A.*) *exclamationis*, L., *Euxoa tritici*, L., *Agrotis ypsilon*, Rott., *Barathra* (*Mamestra*) *brassicae*, L., *Scotogramma* (*M.*) *trifolii*, Rott., *Parastichtis* (*Hadena*) *monoglypha*, Hüfn., *Actinotia* (*Chloantha*) *polyodon*, Clerck, *Trachea atriplicis*, L., *Leucania pallens*, L., *Sideridis albipuncta*, Schiff., *Chloridea* (*Heliothis*) *dipsacea*, L., *Phytometra* (*Plusia*) *gamma*, L., *Catephia alchymista*, Schiff., *Catocala nupta*, L., *Mormonia* (*C.*) *sponsa*, L. Observations on *Episema* (*Diloba*) *coeruleocephala*, L., showed that this species oviposits on branches of pears; the Tachinids, *Compsilura concinnata*, Meig., and *Winthemia quadripustulata*, Meig., were reared from the caterpillars.

Young plants of winter and summer sown grain on one estate were injured in 1913 by *Psylliodes picina*, Marsh., and in 1914 by *P. luteola*, Müll. The latter beetle appeared at the end of April on the edges of fields and on wild grasses in lucerne fields. In July they attacked oak trees, skeletonising the leaves, while at the beginning of August they left the oaks and again invaded corn-fields, where they did serious

damage. *Cassida nebulosa*, L., was observed on beet plantations, the first eggs being noticed on 22nd May. The eggs were laid on *Chenopodium* (goose-foot) and on *Convolvulus*; the larvae appeared on 29th May and pupated about 15th June, the beetles emerging in large numbers on 25th of that month. About 20 per cent. of the adults remained over the winter without ovipositing; the remainder produced a second generation, the development of which lasted about a month and which hibernated without ovipositing. Larvae of *Coeliodes fuliginosus*, Marsh., were found on 19th May on the roots of young poppies. About 95 per cent. of the larvae were parasitised by the Ichneumon, *Tersilochus moderator*, L. Two generations of *C. fuliginosus* are believed to occur in Kiev, the adults of the second one wintering in the soil. Heads of poppy were injured by *Ceuthorrhynchus macula-alba*, Hbst., which winters in the soil as an imago inside a cocoon.

Hylemyia (*Leptohylemyia*) *coarctata*, Fall., damaged wheat and rye; the puparia of this species were found in the soil at a depth of 2 or 3 inches. The flies were on the wing during the second half of June and again in September. They were observed to be preyed on by *Scatophaga stercoraria*, L. Observations on *Oscinella frit*, L., in the laboratory, show that four generations occur in Kiev; the larvae of the fourth generation usually hibernate, though a few of them are able to complete their development and produce adults, which, however, do not oviposit. The wintering larvae were found about the end of April, when they had already damaged winter-sown crops; the second and third generations breed on summer crops, mostly on oats, while the fourth breeds on seedlings of self-sown grain and also on grasses. Although *Opomyza florum*, F., is widely spread in Russia, its life-history has been very little studied and it is probably now recorded for the first time as a pest of cultivated crops. Some larvae, and later their puparia, were discovered on 30th April inside the stems of winter wheat; stems injured by the larvae died. The flies began to emerge on 28th May and continued to do so until the 15th June, and were on the wing during the whole summer. They were found mostly on blossoming peas and in lucerne fields. In August and September, they oviposit in winter-sown fields, the eggs being laid in the soil near the seedlings and remaining over the winter.

Large numbers of larvae of *Pteronus ribesii*, Scop. (*Nematus ventricosus*, Kl.), were noticed on red currants and gooseberries near Kiev. The Tachinid, *Ptychomyia selecta*, Meig., and another unidentified parasite were reared from them and also from *Pristophora pallipes*, Lep., which was observed on red currants and has a similar life-history.

A number of other parasites are recorded, including *Prophanurus terebrans*, Ratz., from the eggs of *Malacosoma neustria*; this species refused to infest the eggs of *Lymantria dispar* and *Orgyia antiqua*; *Prophanurus dalmani*, Ratz., was reared from eggs of *O. antiqua*, but refused those of *M. neustria* and *L. dispar*; it attacked the eggs of *Phalera bucephala*, but no parasites were reared in these cases; this parasite in nature infested 60 per cent. of the eggs of *O. antiqua*. A species of *Trichogramma* (*Pentarthron*) was reared from the wintering eggs of *Thecla betulae*, L., about 65 per cent. being infested; they

attacked in the laboratory, eggs of *Crambus* sp., *Acontia luctuosa*, Hb., *Gonospileia glyphica*, L., *Euxoa segetum*, Schiff., *Thecla betulae*, L., and *Phalera bucephala*, L.; one female can apparently infest as many as 28 eggs of *E. segetum*, two parasites being present in each egg.

The following experiments on insecticides were carried out:— London purple, 10 oz. in 3 gallons of water, caused a death-rate of 32 per cent. among *Cassida nebulosa* on the third day; while Paris green, 60 oz. of green and 120 oz. of quick lime in 27 gallons of water, resulted in a death-rate of 40 per cent. Phytonal, 60 oz. in 27 gallons of water, produced a death-rate of 38 per cent. of *Sitones* sp. on peas. Quassia soap, 1 lb. in 11 or 12 gallons of water, proved less effective against *Aphis pomi*, de Geer, than quassia soap decoction containing 3 lb. of quassia shavings and 2 lb. of green soap in 25 gallons of water. A list of insects reported to the Station by various correspondents concludes the report.

Michailov-Doinikov (A.). **Насѣкомыя, наблюдаемыя въ весенній періодъ 1915 года.** [Insects observed in the spring of 1915.]—**«Садъ, Огородъ и Бахча.** [*Orchard, Market-Garden and Bachza*], *Astrachan*, no. 7, July 1915, pp. 327–333.

This is a list containing the names of 84 species of insects recorded by the Entomological Station of Astrachan during spring 1915. Great damage was done by *Gryllotalpa gryllotalpa*, L., *Biston hirtarius*, Cl., *Lymantria* (*Ocneria*) *dispar*, L., *Pieris brassicae*, L., *Phytometra* (*Plusia*) *gamma*, L., *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.), *Acrolepia assectella*, Zell., which greatly damaged seedlingo nions, *Talis quercella*, Schiff., *Phlyctaenodes sticticalis*, L., *Epicometis* (*Tropinota*) *hirta*, Poda, *Rhynchites auratus*, Scop., *R. bacchus*, L., *Trichiocampus* (*Cladius*) *viminalis*, Fall., and *Eriocampoides limacina*, L. (*Selandria adumbrata*, Klug).

Shtcherbakov (Th. S.). **Энтомологическія замѣтки о клеверѣ.** [Entomological notes on clover.]—**«Вѣстникъ Сельскаго Хозяйства.»** [*Messenger of Agriculture*], *Moscow*, xvi, nos. 23, 20th June, and 24, 27th June 1915, pp. 10–14 and 5–8.

The author discusses the available data as to the injury caused by species of *Apion* and contends that these insects cannot be regarded as very important pests of clover. Dealing with the data obtained from the observations of the Entomological Section of the Shatilov Agricultural Experimental Station and those of A. Sopotzko [see this *Review*, Ser. A, i, p. 483], he points out that the damage actually caused by the larvae of *Apion* to clover cannot be estimated on the basis of the percentage of infested inflorescences, but of the flowers actually destroyed in each of them. The figures obtained at the Station show that, whereas the infestation of heads of *Trifolium pratense perenne*, which is the most highly infested variety of clover, is about 50 per cent. in case of clover not mown in spring, and from 5 to 14 per cent. in case of mown clover, the amount of destroyed flowers never exceeded 1 or 2 per cent. The figures supplied by Sopotzko show higher percentages, viz., from 31 to 92 per cent. of

infested heads of clover and from 5 to 16 per cent. of injured flowers, but even these figures, giving 16 per cent. as the highest percentage of destroyed flowers, cannot be regarded as serious. He is therefore of opinion that there is no reason to apply any expensive remedies to control these weevils. The remedy, usually recommended, of early mowing of clover and the increased harvest obtained by it, has nothing to do with the control of *Apion*, as the mowing simply increases the vigour of the plants and makes the flowering coincide with the time when the greatest number of pollenising insects is on the wing. The necessity for paying more attention to the plants themselves and the conditions affecting their power of resistance to the injuries caused by insect pests, etc., is urged.

Jatzentkovsky (E. V.). **По вопросу объ измѣненіи техники борьбы съ саранчевыми.** [On the question of changing the technique of the control of locusts.]—**«Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd*, nos. 28, 24th July and 29, 31st July 1915, pp. 789–791 and 819–821.

The author disagrees to some extent with the views expressed by B. Uvarov in his recent articles on the campaign against locusts [see this *Review*, Ser. A, ii, p. 65 and Ser. A. iii, p. 109] and contends (1) that there is no reason to return to the old and inferior mechanical means of control ; (2) that the chemical methods still require further investigation as regards the best insecticides, methods of spraying and use of poisoned baits ; (3) that the use of poisoned baits, as recommended by Uvarov, is not always more effective, nor is it less expensive than spraying.

Korolkov (D. M.). **Блѣдноногій крыжовниковый пилильщикъ. Матеріалы по изученію вредныхъ насѣкомыхъ Московской губерніи.** [*Pristiphora pallipes*, Lepeletier (*Nematus appendiculatus*, Hartig). Materials for the study of insect pests of the govt. of Moscow.] Published by the Zemstvo of the govt. of Moscow, *Moscow*, 1915, 43 pp., 16 figs., 3 tables of figs.

Pristiphora pallipes, Lep., is for the first time reported as a serious pest of gooseberries and currants in the government of Moscow, where this sawfly did great damage to these plants in company with *Pteronus ribesii*, Scop., in 1914. Owing to the existence of three and even four generations during one year and of its parthenogenetic reproduction, it may prove even more dangerous than the latter species. During the whole of the summer, the author neither found nor reared males ; the parthenogenesis was confirmed experimentally, by isolating the cocoons in separate glasses containing currant leaves on which the females oviposited. The various stages are described in detail. The females oviposit on the lower side of the leaves of gooseberries and red and white currants, but avoid black currants. Pupation takes place either on the leaves, etc., of the plants or in the earth, in the case of the larvae of the last generation, which hibernate. Three or even four generations may occur in the government of Moscow. This pest is checked by a Chalcid, a species of *Trichogramma* (*Pentharthron*). A solution of Paris green in salammoniac is a good remedy against the larvae.

VAN POETEREN (N.). **De Spruitvreter of Knopworm der Bessenstruiken,** *Incurvaria capitella*, **Fabr.** [The Shoot-eater or Budworm of Bush Fruit (*Incurvaria capitella*, Fabr.)]—*Tijdschr. over Plantenziekten, Wageningen*, xxi, afd. 3, 3rd July 1915, pp. 61–80, 2 plates.

Incurvaria capitella has been long known in Westland and Bangert as a pest of bush fruit, and has been reported almost every year. In 1909 Taschenberg described the young larvae as living in the berries, but this seemed somewhat doubtful, as in Bangert it is regarded as certain that the eggs are to be found on the young wood, and rubbing the wood between the fingers in order to destroy them is commonly practised. In order to test the matter, twigs with eggs on them were cut, placed in pots and watered and their development watched. A number of larvae of an undetermined species of *Cercopis* also hatched in these experiments; this insect is well known in Bangert on bush fruit.

The life-history of *Incurvaria capitella* is as follows:—The moth, which is described and figured, flies in the second half of May and beginning of June; the eggs are laid on the green, half-grown berries, from two to four in the pulp of each. The young larvae live at first within the berries, eating the young and still soft seeds; the attacked fruit begins to colour rapidly and ripens before its time. The larvae then leave these berries for the twigs, on which they spin a web for hibernation, and early in the following spring, they emerge and attack the buds and young shoots, which they hollow out, and have thus acquired their popular name; one larva will damage several shoots or buds. Early in April they are full-grown and drop to the ground, spin a cocoon and pupate a little below the surface. The hibernation webs, which are not easy to find, generally occur about 8 inches above the ground and on old wood; the webs are more loosely constructed than those of *Incurvaria* (*Lampronia*) *rubiella*. According to Chapman, the webs occur on the bud scales at the lower end of the branches, on the buds themselves and on fruiting twigs; the author found them only on the bark, more or less protected by bark scales. The wintering larvae are about 3 mm. long, but lie curled up in the web in such a way that the length is barely 2 mm.; they are usually of a bright red colour. The second feeding period in the spring is well known to growers, and the effect on the shoots is very obvious if the attack is at all severe. The buds are generally bored from the side nearest to the twig, so that the frass lies between the bud and the twig; occasionally two larvae attack the same bud. An attacked twig remains some time before turning black. The shoots, which are attacked later, retain some of their lower leaves, but the central portion is depressed and turns black, growth is arrested and the trusses of bloom never develop. The control of the pest is not easy; hand picking the attacked shoots in April has hitherto been the only remedy suggested which is of any use, and this is laborious, expensive and unsatisfactory; winter washes of alkali or soap and sulphur have also been tried. The attacked shoots are not easily recognised, and unless a very large percentage of the pests is destroyed, the method of hand-picking is all but useless. The Dutch growers prune the bushes rather severely and as late as possible, when the larvae have left their winter quarters and passed into the buds, and in this way large numbers are quickly

and readily destroyed; the prunings are burned at once, but as the larvae live largely in the fruit-bearing branches, which must not be cut away, the method is only very partially successful; the growth of the plant is also interfered with by such late pruning. Attempts to catch the adults on a large scale with lanterns were made in 1906 at Zwaag, but they failed entirely. Leather aprons smeared with an adhesive substance were then tried; these were hung between the bushes and the moths driven on to them; sticky racquets were also used and these gave fairly good results, the apron method having more or less failed. One difficulty connected with catching the moths is that it is more or less waste labour unless carried out before the females have oviposited. At Glimmen, spraying the bushes with a petroleum emulsion was tried, and as this was done just as the moths were beginning to fly, large numbers were knocked down and killed. In the following year, it was found that the sprayed area was much less attacked than others which had not been sprayed, but the test was on too small a scale to be of value. The author recommends a thorough spraying with an 8 per cent. solution of carbolineum about the middle of February; the results are said to be excellent. Control of *Abraxas grossulariata* was obtained at the same time. Though further experience is required as to the effect on the bushes themselves, the necessity for severe pruning is done away with, larger bushes can be grown and consequently more fruit produced. It appears useful to spray as early as the end of January and so to make sure that none of the hibernating larvae have emerged from their webs. The necessity for treating all bushes over a given area is insisted on.

BURGST (C. A. L. Smits van). **Een klein sluipwespje,** *Litus nigriceps*, **sp. n.** [A small parasitic Hymenopteron, *Litus nigriceps*, sp. n.] —*Entomologische Berichten uitgegeven door de Nederlandsche Entomologische Vereeniging, Holland*, iv, no. 80, 1st November 1914, pp. 125–127.

A new Mymarid, *Litus nigriceps*, sp. n., bred from the eggs of an unspecified Homopteron, is described.

DIETZ (P. A.). **Rupsenvraat in Tweede Gewassen.** [Caterpillar attacks on successive crops.]—*Meded. v. h. Deli Proefst., Medan*, ix, pt. 1, June 1915, pp. 8–14.

Considerable attention is now being given in the Dutch East Indies to the question as to how far a particular crop influences the chance of caterpillar attack on the crop which is to follow it, especially when this is tobacco. *Chloridea* (*Heliothis*), *Phytometra* (*Plusia*) and *Prodenia* are found on *Phaseolus mungo* and *Ipomoea batatas*, but not in very great numbers. *Prodenia* is occasionally found on *Ipomoea*, but only one case of *Chloridea* on maize came under the author's notice. Among the succession crops, *Ipomoea batatas* has suffered very seriously from the attack of *Herse* (*Protoparce*) *convolvuli*, especially on the east coast of Sumatra. This pest is widespread and is known to damage various crops in South Africa, and is common in Holland. The eggs are laid singly on the leaves of various plants, but on *Ipomoea* by preference. The caterpillars are often present in such enormous numbers that a distinct odour can be perceived in the fields attacked. In the

Dutch Indies, the wild food-plant of this species is *Ipomoea aquatica*. *Phaseolus mungo* is also attacked and often stripped bare. When driven by hunger, the caterpillars migrate in large bodies to the neighbouring teak bush, in which the bulk of them perish. The damage done to *Ipomoea batatas* depends very largely on the date of appearance of the pest; if the young plants are healthy and growing well the damage is not so great, as this plant has a remarkable power of recovery from injury. The destruction in a plantation of *Phaseolus mungo* is much more serious and often complete. Tobacco, following a crop of *Ipomoea*, is not attacked, nor is Hevea or coffee. Though the damage may be serious in some cases, this insect is also useful, as it greatly assists the colonisation of *Trichogramma*.

A caterpillar feeding on a variety of cowpea (*Vigna catjang*) made its appearance in the middle of November and did a good deal of damage, and may also prove to be a pest of tobacco. It has not been identified, but is thought to be a species of *Mocis* (*Remigia*). A large number of the larvae are attacked by fungus diseases and the eggs are parasitised by *Trichogramma*. On some plantations of *Phaseolus mungo*, the caterpillars of a species of *Phytometra* occurred; they resembled those of a species known to feed on tobacco. They fed readily on tobacco when there was no other food, but preferred *Phaseolus* and its varieties; they were heavily parasitised.

DE BUSSY (L. P.) & DIETZ (P. A.). **Verbranding door Schweinfurter Groen.** [Scorching with Paris Green.] *Meded. v. h. Deli Proefst. Medan*, ix, pt. 1, June 1915, pp. 15–25.

During the years 1907–14, more than five times as much Paris green as lead arsenate was used in the Dutch East Indies, despite the fact that the latter does not scorch tobacco. Not only is Paris green used in preference to lead arsenate, but unsuitable materials are used for diluting it, before dusting the tobacco plants. Damaged, and therefore acid, meal which is often used, will itself scorch the leaves, while ashes, being alkaline, do even greater damage when rain falls after the dusting; coarse sand causes serious mechanical injury to the tender surfaces of the tobacco leaf. The irregular composition of the Paris green is, however, mainly responsible for the damage. Properly made, the average composition of Paris green should be 58 per cent. As_2O_3, 31 per cent. CuO, and 10 per cent. acetic acid. The method of preparation is largely to blame for the defects, as many samples contain free soluble As_2O_3 and this in itself is largely the cause of the scorching which results. Details are given of a number of experiments which support this contention and analyses of samples. Planters are strongly advised to submit this insecticide for analysis. They should never buy Paris green which contains more than 0·4 per cent. of arsenious acid, soluble as such in water, nor use more than 1 per cent. of the green as a dusting powder or one-tenth per cent. if dissolved in water or Bordeaux mixture. If the percentage of soluble acid is at all high, careful trials must be made with weaker dusting mixtures, from $\frac{1}{4}$ to $\frac{1}{2}$ per cent., and the greatest care taken to secure a thorough and uniform mixture of the green with the diluent. Plants should only be dusted when the leaves are quite dry.

KEUCHENIUS (P. E.). **Onderzoekingen en Beschouwingen over eenige Schadelijke Schildluizen van de Koffiekultuur op Java.** [Researches and considerations on some Coccids injurious to Coffee Cultivation in Java.]—*Meded. v. h. Besoekisch Proefstation, Djember*, no. 16, 1915, p. 63, 1 fig., 4 plates.

In September 1913 the author visited certain coffee plantations in Eastern Java, which were all seriously attacked by Coccids. These insects are now the most serious pests of all kinds of coffee on the island. One of the reasons for this is that the cultivation of *Hevea brasiliensis* is increasing and coffee plantations are often not so well cared for as formerly. The species of Coccids concerned are *Coccus* (*Lecanium*) *viridis*, *Saissetia* (*Lecanium*) *hemisphaerica*, *Pseudococcus adonidum*, *P. bicaudatus*, sp. n., *P. citri*, *Pulvinaria psidii*, *Ischnaspis longirostris* (*filiformis*), and *Mytilaspis* sp. Of these, the most important are *C. viridis*, *P. bicaudatus* and *P. citri*, especially the first two.

Coccus viridis, Green, is described and an account of its life-history given. It was first noticed at the end of the last century in Java on Liberian coffee; it is uncertain whether it is an indigenous species. It was first observed in Ceylon in 1882 and, according to Green, was imported with Liberian coffee. It is now distributed over all tropical countries and, as it thrives on many other plants besides coffee, it is a dangerous pest. The author believes that, contrary to the view expressed by Green, *C. viridis* is not ovoviparous. A careful study of the rate of movement of the very young larvae, in search of a place in which to attach themselves, gave a mean speed of 1 metre in 45 minutes, which is sufficient to be a very important factor in the spread of the pest. The resting place preferred is the underside of the leaf and on or close to the central vein, almost invariably with the head turned towards the base of the leaf. The insect probably remains in the same place during its whole life, provided the leaf remains alive. The quantity of sweet exudation produced is greater than in most other Coccids, which increases their attractiveness for ants. In Java reproduction goes on the whole year round and may begin when the insect is 6 weeks old. Zehntner's calculation of the rate of reproduction of *Chionaspis saccharifolii* is regarded as applicable to *C. viridis*, i.e., that one female in October may have nearly 20½ millions of descendants by the middle of the following April. In this part of Java there is evidence that *C. viridis* will live and thrive fairly well at a height of 5,000 feet above sea-level, though under these conditions it is hardly a pest. It is most in evidence at the end of the dry and beginning of the wet season and this unfortunately coincides with the time of most active growth of the coffee plant. The rainy season is unfavourable to the pest; the heavy tropical rains wash away many of the young larvae and a white fungus attacks them and destroys large numbers. The physical condition of the plant has a great influence on the pest, and if it is weak, the scales do not reach their normal development. When the attack is serious, the growth of the plant is arrested, the flowers are scanty and the fruit sets badly and if attacked by the scale aborts and falls. It is generally believed that the direct cause of these injuries is the incessant sucking of the plant juices, but the author thinks that the injection of harmful secretions into the plant also occurs. The fungus, *Cephalosporium*

lecanii, is the most important enemy of this scale, and during the west monsoon enormous numbers are destroyed by it. The insect enemies of *C. viridis* include *Encyrtus bogoriensis*, Zimm., which is said to infest about 15 per cent. of the full-grown scales and possibly a good percentage of the smaller ones, and it should not be despised as an enemy, though its development is too slow to make it effective against a serious outbreak; the larvae of a species of *Eublemma*; the larvae of *Ephestia cautella*, according to Zehntner; the Coccinellids, *Orcus janthinus*, Muls., which destroys large numbers, and *Chilocorus melanophthalmus*, Muls., which is less effective. According to Green, the Chalcids, *Coccophagus orientalis*, How., *Encyrtus flavus*, How., and *Ceraptocerus ceylonensis*, How., destroy this scale in Ceylon, and Rutherford has added a moth, *Cryptoblabes proleucella*, to the list; *Epilachna similis* plays the same rôle in Africa [see this *Review*, i, Ser. A, p. 247].* With regard to *Plagiolepis longipes*, the ant which is accused of protecting the scales and of being useful in spreading *Cephalosporium*, the author considers that it is harmless to coffee because it does not assist the spread of this scale, which it does not cultivate. It materially assists the spread of *Cephalosporium* and checks the development of the sooty fungus by consuming the secretion of the scale. *Oecophylla smaragdina* is to be regarded as a pest, in that it to some extent protects the scales. The planters' remedy against the scale is to limewash the plants, which is considered a good method if thoroughly well done, but conditions make this difficult. Cyanide fumigation has been tried successfully, but is too costly and lengthy a process. The maintenance of vigorous growth in the plant is a most important means of protection. Meijer found that manuring with a mixture of kainit and lime freed the plants from scale. Petroleum soap emulsion must not be used, as the coffee leaf is very sensitive to petroleum and serious scorching occurs; a 4 per cent. solution of soft soap in water is the most practical scalecide. Smoke from heaps of twigs and dead leaves arranged in lines was systematically tried for a whole month on one plantation of 17 acres, but the results have not yet been reported; this method has proved useful against *Helopeltis*, but there is some doubt as to its efficiency against scale-insects.

The second section of this work deals with *Pseudococcus bicaudatus*, sp. n. (the two-tailed white scale). Both sexes are described. The distinctions between the larvae of *P. bicaudatus*, which is believed to be a native pest, and *C. viridis*, are given. The female lays three or four hundred eggs, which hatch in a few hours. The rate of movement of the young larvae is about 3 inches per minute and they retain well developed feet throughout life. The larva is full grown in about 6 weeks and in one case, 39 days after placing a full grown insect on a tree, a third generation appeared; this very rapid multiplication explains the statements of planters that this scale appears suddenly. *P. bicaudatus* occurs from 200 to 3,000 feet above sea level and dry weather suits it best: it thus reaches its maximum at the end of the east monsoon. Heavy rains wash the insects from the trees on to

* Seeing that *E. similis*, like all its congeners, is undoubtedly a plant-feeder and is occasionally an important pest of cereals, Morstatt's statement, here quoted, appears to need confirmation.—Ed.

the ground, as they are by no means so firmly attached as *C. viridis*; it seems to thrive best in the shade. Owing to the enormous numbers in which it may be present, the damage done by the white scale is far greater than that by the green. *Lawana candida*, which is used as a shade tree, *Manihot glaziovii*, *Leucaena glauca*, *Hevea brasiliensis*, Ceara rubber and dadap (*Erythrina lithosperma*) are also attacked. Three Coccinellids, one of them probably *Scymnus bipunctatus*, a species of *Chrysopa*, two Chalcids and a Cecidomyiid, perhaps *Diplosis acarivora*, Zehnt., are mentioned as preying on this scale, but their effect as tested experimentally on an infested plant was relatively small. This scale does not appear to be associated with ants, which seem to avoid the waxy threads which surround it. The outbreaks are thought to begin on the lamtoro (*Lawana*) shade-trees and then spread to the coffee. *Leucaena* is an imported tree which the scale has found suitable as a food-plant. As it appears to attack the healthiest trees by preference, special manuring is of no avail against it. *Lawana candida* should be abandoned as a shade tree and *Leucaena*, near coffee plantations, should be destroyed. The only insecticide suggested is prepared as follows:—$2\frac{1}{4}$ lb. tobacco is well boiled in a gallon of water and the extract filtered, 1 lb. of soft soap is then dissolved in the liquor and, for use, 20 times the volume of water is added; spraying should be done on a sunny day and repeated in 2 or 3 weeks. This gave good results in the laboratory.

Pseudococcus citri is a pest of *Coffea robusta*. A brief description of the insect is given; it is probably not a serious pest, though the damage done is difficult to determine, as it is almost always in the company of *P. bicaudatus*. A bibliography of 37 works concludes this paper.

JANSSENS (—). **La culture du *Manihot glaziovii* à la Station Agricole de l'Etat à Bokala (Moyen Congo).** [The cultivation of *Manihot glaziovii* at the State Agricultural Station at Bokala, Middle Congo.]—*Bull. Agric. Congo Belge, London,* v. no. 3, September 1914, pp. 416–456, 11 figs. 6 diagrams. [Received 11th September 1915.]

Among the insect enemies of *Manihot glaziovii* which occur at Bokala, Middle Congo, are *Pseudococcus* sp.—probably *P. adonidum*—three species of Coleoptera (not specified) and termites.

MAYNÉ (R.). **Les Ennemis de l'Hévéa au Congo Belge.** [*Hevea* pests in the Belgian Congo.]—*Bull. Agric. Congo Belge, London,* v., No. 4, December 1914, pp. 577–596, 8 figs. [Received 15th October 1915.]

Since 1912, the relative freedom from insect pests which *Hevea* had enjoyed in the Congo no longer obtains. The species attacking it are of native origin, and while their importance is not great at present, they require immediate attention in view of the risks involved. The Cerambycid, *Mallodon* (*Stenodontes*) *downesi*, Hope, chiefly attacks *Manihot glaziovii*; the larvae mine the wood, excavate a nymphal chamber near the bark and complete their life-cycle there. Injured trees are easily knocked down by a storm and the fallen trees furnish most favourable breeding places for the beetles. *M. downesi* has been

noticed in dead trunks of *Poinciana regia* and many other species. The destruction of all dead wood and stumps and the scraping of all wounds, followed by painting with coal tar, are the control measures recommended. A mixture of chloroform, 2 parts, and creolin, 1 part, may be injected into the mines in order to kill the larvae within. A mixture of kerosene and carbon bisulphide proved excellent against many Longicorn larvae; the kerosene easily passes the stoppings placed in the galleries and carries the carbon bisulphide with it. This should be useful against *M. downesi* where the wounds are deep and scraping would require too much time. Two unidentified ants, very common in plantations of old *Hevea* trees, are determined enemies of the borer, often penetrating where insecticides cannot reach. Among the CURCULIONIDAE attacking the foliage of *Hevea*, in the Belgian Congo, are:—*Lixus auritus*, Boh., *Blosyrus seminitidus*, Mshll., *Ischnotrachelus humeralis*, Faust, and *Isaniris* sp. Insecticides should be applied where these pests become abundant. In the Kasai district, a new species of *Apion* (*Piezotrachelus*) has been reported as injuring the foliage. The following SCOLYTIDAE are found:—*Xyleborus affinis*, Eichh., *Stephanoderes congonus*, Haged., *S. heveae*, Haged., *Hypothenemus tuberculosus*, Haged., and other species. The Coreid bug, *Anoplocnemis curvipes*, has been reported as attacking *Hevea* in the district of Lake Leopold II. It is probable that the numerous cancer-like lesions on the branches of young *Hevea* trees are the work of sucking insects, similar to this species. It may be controlled by collecting the larvae and adults with hand nets. The Coccid, *Aspidiotus destructor*, has been noticed, apparently for the first time, on *Hevea*; it also occurs on *M. glaziorii* and other trees, the coconut being the favourite host. In Africa, this scale is destroyed by the Coccinellids, *Harmonia maculata*, F. [*sic*], and *Alesia striata*, F. The kerosene-soap emulsion is advised in control. Various species of ants attack *Hevea*, and on cut surfaces a small bee excavates a gallery, which may attain a length of 2 inches. The grasshoppers, *Zonocerus variegatus*, L., and the less common *Z. elegans*, Thunb., devour the parenchyma and skeletonise the leaves. Lead arsenate, Paris green and Scheele's green are the insecticides mentioned. A milk of lime wash is said by Von Faber to be efficacious, though the collection of these insects is preferable. Young plants in the nursery suffer from the attacks of GRYLLIDAE. Against termites fumigation with arsenic sulphide is a radical measure; to keep the insects away from the plants a small quantity of the following paste should be smeared at their base: Paris green 1 part, common salt 2, leaf mould 20, fowl dung 20. Sufficient water is added to form a thick paste.

MAYNÉ (R.). **Note sur un Ennemi du Caféier : le *Stephanoderes coffeae*, Haged.** [A note on an enemy of the coffee tree: *Stephanoderes coffeae*, Haged.] *Bull. Agric. Congo Belge, London*, v, no. 4, December 1914, pp. 596–598. [Received 15th October 1915.]

The Scolytid, *Stephanoderes coffeae*, Haged., is apparently spreading in the coffee plantations in the Belgian Congo. Though it pierces the green berries and attacks the beans, stored and seed coffee suffer most injury. Great cleanliness in the plantations, drying sheds and stores is necessary. Host plants growing in the vicinity of plantations should be destroyed and seed must be disinfected with carbon bisulphide.

MAYNÉ (R.). **Le Papillon des Citrus (*Papilio demoleus*, L.)** [The citrus butterfly, *Papilio demoleus*, L.] —*Bull. Agric. Congo Belge, London*, v, no. 4, December 1914, pp. 598–600. [Received 15th October 1915.]

The larva of *Papilio demodocus*, Esp., which is a very common pest of citrus plants and has also been found on *Zizyphus jujuba* and *Glycosmis pentaphylla*, occurs throughout the Belgian Congo, where young citrus trees are sometimes completely stripped. Observations made in the Lower Congo show that the length of the pupal stage varies with the seasons. In one case a larva pupated on 1st June and the adult emerged on 17th November, 5½ months later. In a second case pupation began in November and the adult appeared after 17 days. In a third instance, during March, emergence took place after 16 days. Collection of the eggs and larvae from the leaves is recommended. Insecticides require to be applied at frequent intervals, which entails expense. A suitable formula is Scheele's green 1 oz., quicklime 1 oz., water 10 gals.

HOOD (J. D.). **A new *Hoplandrothrips* (Thysanoptera) from British Guiana.**—*Canadian Entomologist, London, Ont.*, xlvii, no. 8, August 1915, pp. 241–244, 1 fig.

A description is given of *Hoplandrothrips affinis*, sp. n., obtained from between the leaf sheaths of sugar-cane at Berbice, British Guiana, on 2nd March 1915. This is the only species of the genus yet recorded from South America.

ASHBY (S. F.). **Notes on diseases of cultivated crops observed in 1913-14.**—*Bull. Dept. Agric., Jamaica, Kingston*, ii, no. 8, August 1915, pp. 299–327, 2 plates.

The budrot of the coconut palm has been attributed in part to the action of scale-insects. Recent investigations seem to show that it is due to several species of bacteria. The drying up of one or more of the inner leaves may be due to attack by *Metamasius* (*Sphenophorus*) *sericeus* boring through into the heart. The rhinoceros beetle feeds on the tips of the young leaves; "kreso" disinfectant, 1 part to 10 or 15 parts water, poured into the heart rapidly kills this beetle. Leaf-stalks in the bud are sometimes bored by *Sphenophorus* sp., but it is doubtful if the attack is made on healthy tissue. *Xyleborus perforans* has been found in Jamaica only in diseased and fermenting stems. Scale-insects (*Aspidiotus destructor*, *Diaspis boisduvalii*, *Vinsonia stellifera*) are the most serious pests of coconut. The leaves and pods of cacao suffer from the attacks of thrips, especially in dry weather. They can be controlled by spraying with kerosene emulsion. Citrus trees on the dry plains near the coast are attacked by *Lepidosaphes beckii* (purple scale) and *Chionaspis citri* (snow scale). *Aspidiotiphagus citrinus*, a Chalcid parasitic on these scales, is very abundant in Jamaica. A mite is frequently associated with the snow scale and probably feeds on its eggs. Three species of fungi, *Sphaerostilbe coccophila*, *Myriangium duriaei* and *Ophionectria coccicola*, are the most important enemies of scales, especially in the higher or wetter districts. Insecticides used in the control of the scales do not destroy the fungi, but are injurious

to the Chalcid. In dry districts the fungi are active only in the wet seasons; in these districts trees should be sprayed at least twice between spring and summer rains, and an attempt should be made a few weeks later to reintroduce the Chalcid and mite from unsprayed trees. Twigs bearing the fungi should be introduced at the beginning of the rains.

Aleurocanthus woglumi, Quaint., has become abundant on the leaves of all species of citrus. The eggs are laid on the under surface of the leaves. The larva hatches in about 11 days and reaches maturity about 29 days later; the pupal stages lasts at least 3 weeks. During January to March 1913, the complete life-cycle from egg to egg occupied at least 9 weeks. In warmer months development is more rapid; at least 5 broods are produced annually and there is no period of hibernation. Severe infestation checks growth and has a marked effect on the setting and size of the fruit. In 1914 fungus parasites were found in the larvae; the most effective kinds were a red non-spore-bearing species (brown fungus of Florida) and a species apparently identical with *Aschersonia aleurodis*. The larval stages are probably most susceptible to an oil emulsion spray when moulting. Since mango is also infested by this insect, it must be sprayed if grown near citrus trees. A list of fungicides and insecticides is appended. The following formulae are recommended: (1) kerosene emulsion: ¾ lb. soap, 1 gal water, 2 gals. kerosene, 1 gal. stock solution to be diluted with 10 or 15 gals. water; (2) lime-sulphur wash: 15 to 20 lb. stone lime, 15 lb. flowers of sulphur, 50 gals. water. A mixture of 3 parts flowers of sulphur and 1 part air-slaked lime is useful against red spider on citrus, vine and sweet potato.

RITCHIE (A. H.). **Economic Entomology in Jamaica.**—*Bull. Dept. Agric., Jamaica, Kingston,* ii, no. 8, 1915, pp. 335–338.

The necessity for co-operation between official and planter in order to further the interests of agriculture in Jamaica is urged. Economically sound and practical measures, recommended after thorough consideration, should, if necessary, be backed by legislation. In entomological work in the Colonies the question of freight on insecticides may be an important item in considering the value of certain measures of control. Concentrated lime-sulphur solution is a valuable contact spray material against rust mite, red spider, etc., which falls under this category. So far, attempts to produce this in an effective solid form have failed. Experiments with barium as a base have shown that one at least of the polysulphides of barium, viz. barium tetrasulphide, can be produced in a soluble crystalline form. Opportunity will be taken to test the Bordeaux-nicotine sulphate spray against thrips and pod-rot of cacao. The use of quassia decoction as a contact spray has long been known. As *Picroena excelsa*, Swz. (bitter wood) grows in abundance in Jamaica, the effectiveness of a decoction of it will be investigated. In California good results have been obtained against certain Aphids with a mixture consisting of 3 lb. quassia, 3 lb. whale oil soap, and 100 gals. water.

Locusts.—*Agric. News, Barbados*, xiv, no. 343, 19th June 1915, p. 203.

The fears that locusts might invade Trinidad from Venezuela [see this *Review*, Ser. A, iii, p. 618] appear to have been justified, since specimens of *Schistocerca paranensis*, the South American migratory locust, have been taken at Chacachacare, Trinidad, large swarms arriving there on 30th May. A related form, *S. pallens*, is the common grasshopper in the West Indian Islands, whilst *S. americana* is the abundant, and sometimes seriously injurious locust of the southern United States. Spraying with lead arsenate or sodium arsenate and the use of a poisoned-bran bait are effective against the adults and will prevent the laying of eggs in large quantities; the eggs should be destroyed by ploughing or digging the ground.

Cleare (L. D.). **Note on the recent Attack of** *Brassolis sophorae*.—*Jl. Bd. Agric. Brit. Guiana, Georgetown*, viii, no. 3, July 1915, pp. 86–87.

Coconut palms in Georgetown suffered from an attack of *Brassolis sophorae* during the past year. This pest has been previously recorded from the East coast at Berbice and Essequibo and is probably to be found along the entire coastlands. It has been recorded from Dutch Guiana and Trinidad. The spread of the insects in Georgetown was in opposition to the prevailing winds. By September, the insects had almost disappeared. About 5 per cent. of the palms were killed by the attack. The natural enemies of *B. sophorae* include a bird, *Pitangus sulphuratus*, and parasites of eggs and pupae. The habit of the larvae of feeding by night and living in nests in the daytime offers the easiest means of control, viz., the collection of leaves bearing the nests.

Froggatt (W. W.). **A descriptive Catalogue of the Scale Insects ("Coccidae") of Australia.**—*Agric. Gaz. of New South Wales, Sydney*, xxvi, no. 6, June 1915, pp. 511–516, plate 12.

The following species of Coccidae are recorded:—*Ctenochiton araucariae*, Green, on the foliage of *Araucaria* sp. (Bunya pine); *C. cellulosus*, Cock., on the leaves of *Melaleuca nodosa*; *C. eucalypti*, Mask., on the leaves of *Eucalyptus siderophloia*; *C. rhizophorae*, Mask., on *Rhizophora mucronata* (mangrove); *C. serrata*, sp. n., on the leaves of *Acacia* sp.; *C. transparens*, sp. n.; *Cardiococcus* (*Inglisia*) *foraminifer*, Mask., on *Santalum acuminatum*, *Loranthus* and some undetermined shrubs; *Cardiococcus* (*I.*) *fossilis*, Mask., on *Acacia* sp., *Muhlenbeckia adpressa* and an undetermined shrub; and *Ceroplastodes melaleucae*, Green, on *Melaleuca nodosa*.

Froggatt (W. W.). **A descriptive Catalogue of the Scale Insects ("Coccidae") of Australia.**—*Agric. Gaz. New South Wales, Sydney*, xxvi, no. 7, July 1915, pp. 603–615, plates 13–15.

The following species of Coccidae found in Australia are recorded:—*Saissetia* (*Lecanium*) *anthurii*, Boisd., infesting asparagus; *Eulecanium* (*L.*) *berberidis*, Schrank, common on grape vines in the vicinity of Sydney; *L. cappari*, sp. n., found on the foliage of *Capparis mitchelli* (wild orange bush) in western New South Wales; *L. casuarinae*, Mask.,

collected in the deserted chambers of Hepialid moth larvae in the stem of *Casuarina* sp.; *Saissetia* (*L.*) *depressum*, Targ., confined chiefly to hot-house plants, including grape-vines; *Paralecanium* (*L.*) *expansum*, Green, found on the leaves of *Ficus macrophylla*; *Saissetia* (*L.*) *filicum*, Boisd., a common scale of hot-house ferns; *Saissetia* (*L.*) *hemisphaerica*, having a wide distribution in Australia; *Coccus* (*L.*) *hesperidum*, L., occurring on orange; *Coccus* (*L.*) *longulus*, Doug., on *Anona reticulata* (custard apple); *Saissetia* (*L.*) *oleae*, Bern., and *Eulecanium* (*L.*) *persicae*, F., found on grape, peach, mulberry, plum, etc. [The papers of this series, which were published in Vol. xxv. (1914) of the *Agric. Gaz. of New South Wales*, have now been issued as Science Bulletin no. 14 of April 1915, obtainable from the Under Secretary, Dept. of Agriculture, Sydney.]

HORTON (J. R.) & PEMBERTON (C. E.). **Katydids injurious to Oranges in California.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 256, 27th July 1915, 24 pp., 16 figs., 5 plates.

Citrus trees in the San Joaquin Valley of California are attacked by *Scudderia furcata*, Brunner, (fork-tailed katydid) and *Orophus* (*Microcentrum*) *rhombifolius*, Sauss., (angular-winged katydid). In 1912, the loss caused by the former species amounted to a quarter of the crop. *S. furcata* feeds almost exclusively on the sweet orange; it has also been reported as feeding on the fruit and leaves of grape and the leaves of oak. The egg is inserted into the edge of the older leaves of the citrus tree, between the upper and lower surfaces; the average number deposited in a single leaf is three. The winter is passed in the egg-stage. The duration of this stage varies from 275 to 286 days, the eggs deposited later in the year having the shorter incubation period; this generally lasting from the middle of August until the middle of May. The egg of *S. furcata* is attacked by a Chalcidoid parasite, *Anastatus* sp. The proportion of eggs parasitised among those under observation in 1912, was 25 per cent. From eggs collected on 22nd March, adult parasites began to emerge on 2nd April. In every case only one parasite emerged from a single egg. The complete nymphal stage requires from 58 to 88 days. Nymphs issuing early in spring develop more slowly than those emerging later. The young feed actively at the time the host trees are beginning to lose their petals; the pistil and ovary and the immature fruit are attacked. In 47 orchards examined during 1912, the loss of fruit from this cause averaged 8·2 per cent. of the maturing crop. Preference was shown by the insect for young, vigorously growing orchards. The leaves and stems of the orange are attacked throughout the life of the insect. Birds and a spider, *Thiodina puerperis*, Htz., are the most important enemies of the nymph. Transformation to the adult stage takes place between the middle of June and the middle of July. Pairing occurs about 20 days after emergence. Oviposition takes place at night and decreases in autumn, ceasing entirely about mid-winter. Females which have ceased to oviposit may be induced to begin again by placing them in a temperature of 75° F. Adults kept in captivity lived from 150 to 160 days.

Orophus rhombifolius is associated with *S. furcata* on orange trees; the foliage only is attacked by this species. The distribution is the

same as that of *S. furcata*, both species having been recorded from the New England States, Florida and California. The eggs are deposited in September and October and are glued in double rows along the sides of twigs. The average duration of the egg-stage is 225 days. Hatching takes place during May. The greatest enemy of this species in California is *Anastatus* sp., about 80 per cent. of the eggs being parasitised. The average duration of the nymphal stage is 73 days. Pairing takes place from 18 to 26 days after emergence. The length of life of the adult is about 3½ months. Several methods of control have been suggested, some of which have been found impracticable, such as destruction of nymphs by hand, collection and destruction of eggs and the use of trap crops and poisoned baits. Sprays are more effective. Zinc arsenite at the rate of 2 lb. to 100 U.S. gals. water killed 93·1 per cent. of *S. furcata* and 100 per cent. of *O. rhombifolius* in the 1st, 2nd or 3rd instars. Lead arsenate at the rate of 4 lb. to 100 gals. water killed 100 per cent. in each case. The results of the season's spraying work were manifested by preventing the loss of fruit by dropping ; by almost complete prevention of injury to mature fruit and leaves and reduction in the amount and severity of injury by thrips ; and by improvement in the amount and vigour of growth of the sprayed trees. The addition of lime-sulphur to the arsenicals facilitated their even distribution over leaves and fruit. Two applications of zinc arsenite or two applications of lead arsenate, in the above proportions, are advised ; lime-sulphur may be added at the rate of 2 gals. per 100 gals. of spray. The first application should be made as soon as the petals have fallen, the second from 10 to 14 days later. An application of lime-sulphur alone may be made about 2 or 3 weeks after the second spray.

BLAKESLEE (E. B.). **American Plum Borer.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 261, 19th July 1915, 13 pp., 1 fig., 3 plates.

Euzophera semifuneralis, Walk. (the American plum-borer), some of the synonyms of which are *E. impletella*, Zell., and *Stenoptycha lulella*, Hulst, is widely distributed in the U.S.A. It feeds upon plum, peach, cherry, apple, Chinese plum, Kieffer pear, mountain ash, persimmon and Russian mulberry, being found in equal abundance on the first four. The feeding habits of this insect are of special interest when contrasted with those of other wood-boring species. *E. semifuneralis* prefers trees which are not dead and yet are not in too vigorous condition. Beginning at a scar, wound, or crevice, where a bark scale offers partial protection, the larva works its way into the living tissue, in broad, shallow, irregular galleries just beneath the bark. Apple trees partially girdled by collar blight and trees injured mechanically by frost or by some other cause offer the ideal condition for this borer, which considerably shortens their life. Entirely healthy and uninjured trees are rarely attacked and, except in isolated cases, the plum-borer will probably never become a pest of great importance. A description of the various stages is given. In the spring of 1915, the pupation of the wintering larvae began about the end of March or beginning of April, in the latitude of northern Virginia and the district of Columbia. As far south as Georgia, this probably occurs a month

earlier. In normal seasons, the emergence of the spring brood of adults probably begins about the end of April or beginning of May. In the laboratory, mating and oviposition took place in from 1 to 3 days after emergence. The eggs hatched in 8 to 10 days. In northern Virginia, eggs of the second generation hatch about 1st July. Whether all the first-brood larvae transform to moths in the same season is unknown. It seems fairly certain, however, that there is at least a partial second generation, though there is evidently considerable overlapping of the two generations. In the late autumn the larva constructs under the bark scales at the entrance to its feeding galleries, a loose, light, but very tough cocoon of white silk. Observations in 1912 and 1913 indicate that many of the larvae hibernate in an immature state, but in the spring of 1913, no evidences of feeding were found among about 100 larvae collected in the field, and all undersized specimens proved to be parasitised. In favourable years immature larvae may succeed in passing the winter successfully in northern Virginia, but the mortality among such larvae due to winter conditions must be very high in this latitude. The larvae usually pupate in the cocoon in which they pass the winter. Of the natural enemies of *E. semifuneralis*, two parasites, reared in 1913, proved to be a species of *Idechthis* and *Mesostenus thoracicus*, Cress. The former was the commoner and parasitised 13·47 per cent. of a batch of 104 overwintering larvae. *Itoplectis marginatus*, Prov., *Mesostenus gracilis*, Cress., and *Pimpla* sp. have also been reared from this species. Among the predaceous enemies, the larva of *Tenebroides corticalis*, Melsh., has been taken feeding upon the borer. Ants and woodpeckers are also important factors in reducing the numbers. The only advisable control measure is the cutting away of the dead bark and painting the wounded areas on the already injured trees which offer an opening to this pest. A bibliography of 12 works concludes this paper.

Robinson (R. H.) & Tartar (H. V.). **The Arsenates of Lead.** *Oregon Agric. Coll. Expt. Station, Corvallis, Oregon*, Bulletin 128, May 1915, 32 pp., 3 figs. [Received 10th August 1915.]

There are two common lead arsenates, lead hydrogen arsenate and lead orthoarsenate, and these are the main components of ordinary commercial lead arsenate. As there is very little accurate knowledge of the preparation or the chemical and physical properties of the pure compounds, the authors have made a series of investigations on the subject, and details are given of methods used for the preparation of the pure salts. Pure lead hydrogen arsenate, $PbHAsO_4$, is a white, amorphous, finely divided, fluffy powder containing theoretically 33·15 per cent. As_2O_5 and 64·46 per cent. PbO. Attempts to prepare pure lead orthoarsenate, $Pb_3(AsO_4)_2$, which theoretically should contain 25·57 per cent. As_2O_5 and 74·43 per cent. PbO, resulted in the production of a new basic lead arsenate, and the authors conclude that lead orthoarsenate is not formed under the ordinary aqueous solutions employed in the manufacture of commercial lead arsenate, and that it is not a component of the commercial materials, as has been formerly supposed. Lead pyroarsenate, from its very constitution, cannot be a constituent of the commercial lead arsenate. The physical differences between basic and hydrogen lead arsenate are described.

The acid salt has a general resemblance to wheat flour ; both salts are amorphous under ordinary conditions, and their ultimate particles, under the usual conditions of preparation, are about the same size, but when suspended in water the particles of the basic salt have a tendency to collect together into larger particles and thus to settle more rapidly, and it is possibly this property which prevents it from spreading so evenly over foliage as does the acid salt. The fruit-grower, in handling materials of this kind, requires fine subdivision and low gravity, so that they will remain a long time in suspension. The specific gravity of both was very carefully determined by the authors, and they found that of the acid salt to be 5·786 and that of the basic 7·105. Suspension and settling experiments were made with both and a photograph is reproduced showing the amount of settlement in 2 minutes and 1 hour respectively ; in the former case the basic salt had practically all settled and the acid salt only slightly, in the latter the basic salt had completely settled, leaving the supernatant liquid quite clear, while the acid salt still showed particles in suspension. The question of solubility is of great importance to users, as a very small amount of soluble arsenic compounds is sufficient to cause injury to foliage. It has also been fully demonstrated that insoluble arsenical compounds are effective as stomach poisons, the arsenic being probably set free by the solvent action of the juices of the digestive tract of the insect. The tendency of manufacturers is to supply an insoluble form, and this has been stimulated by the passing of State and national laws restricting the amount of soluble arsenic permissible in commercial lead arsenates. A difficult chemical question is involved in determining the solubility of these salts, as water under certain conditions reacts chemically with them, producing other soluble bodies. The authors feel warranted in asserting that, with the pure acid salt, this hydrolytic action is so small as to be negligible, and the same appears to be true of the pure basic salt. The commercial article is however not pure; the nature of the impurities varies, and with it the possibility of reactions occurring, which will set free soluble arsenic. The result of spraying experiments with each of the arsenates (presumably laboratory made and pure, though this is not definitely stated) at strengths of 2, 4 and 8 lb. in 100 U.S. gallons (83 Imperial) of water is given and in no case did scorching occur. Lead hydrogen arsenate, like most acid salts, reacts readily with many substances, and sodium chloride, carbonate and sulphate were found to liberate arsenic from it in considerable quantity ; alkalies gave the same result ; the basic salt is relatively inert, but nevertheless reacts to some extent with the salts above mentioned. Experiments were made with the two arsenates at the usual spray strengths on tent caterpillars [*Malacosoma* spp.] and controls were sprayed with suspensions which contained equal amounts of arsenic in the form of the different arsenates. The acid arsenate was found to act more quickly than the basic, though the latter finally killed the caterpillars. One result of these experiments, which the authors intend to repeat, seemed to be that in ordinary spraying practice the arsenates of lead are perhaps used in greater quantity than is necessary. The chemistry of the assaying of lead arsenate by various methods is discussed, and the results show that the conditions laid down in the Federal Insecticide Law are, in

the case of basic arsenate, impossible of fulfilment; the law says that it must contain not less than 12½ per cent. of arsenic oxide, the pure laboratory product only containing 11·71 per cent. The official methods of assay are criticised as not giving the true amount of water-soluble constituents, and as many of these are impurities, possibly adulterants, which will react chemically with the lead salt and liberate soluble arsenic, their proper determination is of considerable consequence. The last chapter of this bulletin is devoted to the chemical reactions between the lead arsenates and lime-sulphur, and it is shown that, when such mixture is made with the acid salt in the proportions usual in field practice, considerable quantities of lead sulphide and calcium arsenate are formed and free sulphur deposited, and that appreciable quantities of arsenic pass into solution owing to the solubility of the calcium arsenate; with the basic salt, the reaction with lime-sulphur is comparatively slight.

BENTLEY (G. M.). **The Tennessee Nursery Law, and condensed requirements relative to inter-State Shipments of Nursery Stock.**—*Tennessee State Bd. Entom., Knoxville,* iv, no. 2, Bull. no. 13, June 1915, 32 pp., 2 figs.

This bulletin gives a statement of the terms of the Tennessee Nursery Law, approved 17th April 1905 and amended 6th July 1915. The following insects are declared to constitute infestation in trees and plants:—*Aspidiotus perniciosus* (San José scale), *Aulacaspis pentagona* (West Indian peach scale), *Eriosoma* (*Schizoneura*) *lanigerum* (woolly aphis), *Anthonomus grandis* (Mexican cotton-boll weevil), *Lymantria* (*Porthetria*) *dispar* (gipsy moth), *Euproctis chrysorrhoea* (brown-tail moth), *Ceratitis capitata* (Mediterranean fruit-fly), *Phthorimaea operculella* (potato tuber moth), *Aleurodes citri* and *A. nubifera* (citrus whitefly). A brief summary of the laws of other States and of Canada relative to the shipping, inspection and certification of nursery stock, is given. Insects which have been declared pests in Canada are the same as those given above, with the exception of the two *Aleurodes*.

EHRHORN (E. M.). **Report of the Division of Entomology.**—*Hawaiian Forester and Agriculturalist, Honolulu,* xii, no. 7, July 1915, pp. 177–183.

During April 1915, the following pests were intercepted:—Termites on hop-vine roots from California; *Chermes* sp. on cherry from Japan; bulb aphis on gladiolus bulbs; Aphids on roses; a weevil and Chalcid parasites on palm seeds from Cuba; cabbage maggot [*Hylemyia antiqua*] on turnip; potato tuber moth [*Phthorimaea operculella*] on potato. During May, Japanese and Chinese rice, beans, corn from Manchuria and buckwheat from Oriental ports were found free from insect pests. The following additional pests were intercepted:—*Anomala* sp. and ants on the roots of cherry from Japan; *Bruchus chinensis* in beans from Japan; and Aphids on hydrangea from Pennsylvania. In the insectary large numbers of various parasites

were reared and liberated. Complaints were received of damage by the Japanese rose beetle; a number of inoculated beetles were distributed.

Scarioli (G.). **Bromius vitis.**—*Venezia agricola, Venice,* xviii, no. 31, 1st August 1915, p. 3.

Adoxus (*Bromius*) *vitis* attacks the leaves of vines in June and July, causing them to wither and fall, and thus preventing the normal development of the grapes. The eggs are not attached to the leaf-surfaces and would fall off were they not usually deposited in curled-up leaves. The larvae attack the roots, in which they mine longitudinal galleries. According to Thenard, mustard-seed cake provides an efficient means of control. Carbon bisulphide may be used towards the end of autumn, before the insect burrows deep into the soil to hibernate. In Burgundy, a kind of umbrella is used for collecting the adults.

Rohwer (S. A.). **Descriptions of New Species of Hymenoptera.**—*Proc. U. S. Nat. Mus., Washington,* xlix, no. 2105, 16th July 1915, pp. 205–249.

This paper contains descriptions of 47 new species of Hymenoptera, many of which are of economic importance either as parasites or as defoliators.

Tenthredinidae.—*Pontania amentivora,* sp. n., lives in the larval stage in catkins of *Salix* sp. and causes the destruction of the ovaries; it pupates in a cocoon in the ground; *Pteronidea winnanae,* Rohwer, feeds in the larval stage on *Salix* sp.; the larvae of *Croesus castaneae,* sp. n., feed gregariously on the leaves of *Castanea dentata*; the adult emerges in September; *Euura cosensi,* sp. n., was reared from galls on *Salix humilis.*

Ichneumonidae.—*Pezoporus tenthredinarium,* sp. n., was reared from a sawfly leaf-miner on cherry; *Lagarotis diprioni,* and *L. virginianus,* sp. n., are primary parasites on the sawfly, *Lophyrus* (*Diprion*) *lecontei.* *Homalomma caliroae,* sp. n., is a primary parasite on *Eriocampoides* sp., which feeds on *Nyssa sylvatica.* *H. eriocampoides,* sp. n., is parasitic on *Eriocampoides* sp., which feeds on *Quercus prinus*; *Polypterus caliroae,* sp. n., is parasitic on *Eriocampoides* sp., attacking *Quercus ruber.* *Moerophora neoclyti,* sp. n., is parasitic on *Neoclytis capraea,* Say, [*sic*—? *Neoclytus caprea*] attacking *Quercus arizonica*; *Amersibia prionoxysti,* sp. n., is a primary parasite on *Prionoxystus* in chestnut; from observations so far available, it kills the host larva in the 4th or 5th instar; *Scambus evetrivorus,* sp. n., has been reared from *Rhyacionia* (*Evetria*) *bushnelli,* Busck, infesting *Pinus ponderosa*; *Camposcopus aclerivora,* sp. n., is a parasite of *Acleris* sp., occurring on chestnut.

Braconidae.—*Apanteles sibinidis,* sp. n., and *A. phobetri,* sp. n., are parasitic on the moths *Sibine stimulea* and *Phobetron pithecium* respectively. *Bassus coleophorae,* sp. n., and *Microbracon coleophorae,* sp. n., are parasitic on *Coleophora leucochrysella,* Clemens, feeding on chestnut.

FINK (D. E.). **The Verbena Bud Moth.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 226, 27th May 1915, 7 pp., 1 fig., 3 plates.

Olethreutes hebesana, Walk., (verbena bud moth) was found during the autumn of 1913 infesting *Antirrhinum* sp. (snapdragon). This insect is apparently locally distributed throughout the eastern parts of the United States and Canada. Injury is confined to flowering plants. It has been reared from and found injurious to *Tigridia pavonia* (tiger flower), *Antirrhinum* spp., *Iris* spp., *Verbascum thapsus* (mullein), *Verbena* spp., and *Dasystoma flava* (false foxglove). The eggs are deposited singly or in small groups on the sepals of the flower buds or on the upper part of the flower stalk. The first eggs are laid by adults emerging during March from overwintering pupae. In the vicinity of Norfolk, Va., 5 or 6 generations are produced annually. Oviposition occurs several days after emergence and was first observed on 2nd April. The larvae feed at first on the flower bud and later attack other parts, including the seed capsules, in which, during the winter, larvae in all stages, as well as pupae, may be found. Under laboratory conditions the life-cycle occupied 43 days. Methods of control which were found effective against the larva, include the use of poison sprays and the cutting back and destruction of infested stalks. The following poisons were used:—(1) Arsenate of lead, 2 lb. to 50 U.S. gals. water and fish-oil soap, 2 lb. to 50 gals. water; (2) zinc arsenite, $1\frac{1}{2}$ lb. to 50 U.S. gals. water, and fish-oil soap 2 lb. to 50 U.S. gals. water. Spraying was carried out as soon as the larvae began to hatch; from 85 to 90 per cent. were killed. By cutting back infested parts during the autumn, all stages of the insect are got rid of.

THEOBALD (F. V.). **Report on Economic Zoology for the year ended September 30th 1913.**—*Jl. of the South Eastern Agric. Coll., Wye, Kent*, for the year 1913, pp. 193–386, 17 plates and 69 text figs. [Received 26th March 1915.]

This report contains a great variety of records of damage by insect pests, including attacks by the larvae of *Dasychira pudibunda*, L., in Herefordshire, and by *Naenia typica*, L., the Dark Gothic Moth, in other localities, on apples. *Athetis clavipalpis* (*Caradrina quadripunctata*, F.) at Blairmore attacked stored apples, peaches, cucumbers and marrows. The larvae of *Olethreutes* (*Antithesia*) *pruniana*, Hb., did great damage to apples near Worcester, and larvae of *Melolontha melolontha* were found eating the finer roots of standard apples, doing such damage as to necessitate the removal of the trees. Mustard blossom beetles (*Meligethes* spp.) are now to be regarded as serious pests of pear and apple blossom, and growers are beginning to recognise that the leaf weevils, *Phyllobius* spp., are serious pests of apple and pear blossoms and that lead arsenate spray is a useful remedy against them. A successful attempt to control the woolly aphis [*Eriosoma lanigerum*] by banding the trees with tanglefoot is recorded. The plum leaf sawfly, *Priophorus* (*Cladius*) *padi*, L., though not a common pest, was reported as doing great damage in one locality, and in another *Xyleborus dispar*, F., killed thirty young plum trees. Larvae of

Hepialus lupulinus, L., attacked strawberries, and the vine moth, *Batodes angustiorana*, Haw., did much damage in a late vinery. Larvae of *Dasycera sulphurella* have been found on the bark of apple, ash and elm. During 1913, currant and apple Aphids were very numerous, but were largely destroyed by a fungus, probably a species of *Empusa*. Insects injuring hops included *Acronycta rumicis* and *Bibio hortulanus*. Observations on the effect of basic slag on Aphids do not confirm the German results. The clover midge, *Amblyspatha ormerodi*, Kiefler, was reported from various places; it appears to attack only red clover. Serious damage to cabbage by larvae of *Phytomyza flavicornis*, Meig., was reported near London. Experiments with a soap-nicotine spray against leaf-mining Diptera, *Acidia heraclei* on celery and *Phytomyza* sp. on marguerites and chrysanthemums, gave good results, but the cost for celery is prohibitive. The following Aphids are recorded as injuring willow:—*Aphis saliceti*, Kalt., *Cavariella* (*Siphocoryne*) *capreae*, F., *Melanoxantherium salicis*, L., *Pterocomma pilosa*, Buck., and *Lachnus viminalis*, Fonsc., as well as the beetles, *Phratora vitellinae*, Kirby, *P. vulgatissima*, L., *Galerucella lineola* F., *G. tenella*, L., *Crepidodera aurata*, Marsh., and *Cryptorrhynchus lapathi*, L. The beech Aphis, *Phyllaphis fagi*, L., was specially numerous and in certain localities did much damage. The abundance of material has enabled certain details of life-history to be cleared up. Larvae of *Aglossa pinguinalis*, L., (tabby or grease moth) were reported as destroying stored barley.

Van Hall (C. J. J.). **Cocoa.** Macmillan & Co., London, 1914, 515 pp. 140 figs., Price 14*s*. net.

The eighth chapter of this book contains a full account of the insect pests of cacao and the methods of combating them, and in the ninth chapter, "Cocoa-growing Countries," which occupies nearly one-half of the book, the methods of cultivation in each country are described, and the special insect pests concerned are referred to.

Scapteriscus didactylus only attacks young and succulent plants, on the roots and stems of which it feeds; it destroys far more than it consumes and a small number of these mole-crickets may kill a large number of plants in one night; when the young plants have reached a height of from 9 to 12 inches, they are practically safe from attack. In Surinam plantations it is usual to have a nursery, the principal object of which is to fill the gaps caused by this pest. The insect does not become fully developed for one or possibly two years; as soon as the larvae are strong enough, they tunnel in search of food and are rarely seen above ground, unless driven to the surface by heavy rains. The fully developed adults are more often seen and at times migrate in numbers, for reasons not well understood. Kitchen gardens, tobacco, rice and sugar-cane suffer seriously, but thorough weeding, frequent disturbance of the soil and a trench round the area to be protected, if small, will generally suffice to drive and keep them away. The best method of protecting cacao plantations is to raise the seedlings in small, well protected nurseries and not plant out until they are hard enough to be distasteful to the pest.

Stirastoma depressum is the worst pest of cacao in the New World, and attacks also the American cotton tree (*Bombax ceiba*)

and *Pachira aquatica*, known in Trinidad as "chataigne maron" and in Surinam as wild or forest cacao. The eggs are laid at irregular intervals during several weeks, never in wounds or cracks or on the bark, but in a specially made bore-hole, at the fork or near the foot of lateral branches or, in young trees, just above the soil. The larva makes a spiral tunnel under the bark and ultimately rings the branch or young stem. The adults do damage by gnawing the bark of the young branches. In the author's opinion, the ordinary method of combating this pest by excising the larvae often does more damage than the pest itself. Trap trees such as *Bombax ceiba* or *Hibiscus esculentus* have had some success in Surinam. Guppy recommends branches of *Pachira aquatica* placed in heaps under the cacao trees or hung from the branches, and at the same time spraying with arsenate of lead; prunings of cacao can also be used. Injection of carbon bisulphide into the holes is not always successful, and whatever other measures are adopted, hand-picking and collection of the beetles must be vigorously carried on. [See this *Review*, Ser. A, i, pp. 122 and 425, and A, ii, p. 460].

Glenea novemguttata is the commonest and most destructive cacao-borer in Java; the eggs are laid singly in separate incisions in the bark; the tunnels are bored close under the surface of the bark, and when fully grown the larvae bore into the wood and make a chamber about an inch long in which they pupate. The remedies used in Java are excision of the larvae and collection of the beetles; Zehntner recommended lime-washing the stems and branches; dead branches or prunings should never be left on the ground. This borer has occasionally been found in Kapok trees (*Eriodendron anfractuosum*). *Pelargoderus bipunctatus* and *Monochamus* (*Monohammus*) *fistulator* are also harmful cacao-borers in Java and in some cases the damage done is very serious. The former also lives in canary trees (*Canarium commune*) and in old pepper plants, and is also a pest of *Ficus elastica* [see this *Review* Ser. A, ii, p. 535]. *M. fistulator* attacks coffee and castor oil plants, and an allied species, *M. ruspator*, is a pest of cacao in the Cameroons [see this *Review*, Ser. A, ii, p. 415]. The Buprestid, *Catorantha bicolor*, F., was at one time a very serious pest of cacao in Java, but of late years it has ceased to appear in large numbers. This beetle is also found in Burma where, according to Stebbing, it attacks pyinkadu trees in the forests. In Trinidad, Java and elsewhere, various species of *Xyleborus* damage cacao [see this *Review*, Ser. A, i, pp. 350 and 513]. *Zeuzera coffeae* is comparatively common in Java and now and then causes serious damage. An allied species, known as the San Thomé borer does much damage in the Cameroons and on the island of San Thomé.

Helopeltis theivora and *H. antonii* are nearly as serious pests of cacao as the cacao moth; the former is prevalent in hot climates whereas the latter is commoner in the cooler regions in Java. Another species [*H. bergrothi*] has been described as damaging cacao on the Gold Coast [see this *Review*, Ser. A, ii, p. 671]. The eggs are laid in the young fruits and sometimes in young twigs; the whole development takes place in two or three weeks and the life of the adult is not less than 2½ to 3 months. The attack is most severe in the rainy season. In Java the worst months are March to May, and in Ceylon, December and January. The question of how this insect survives the dry season

is still unsettled [see this *Review*, Ser. A, i, p. 370]. Green assumed the existence of "winter eggs" which only hatched with the first rains; according to Zehntner, on the approach of the dry season the females retire to low, damp spots, often near streams running through the plantations, and this agrees with the observed fact that this pest generally first reappears in the neighbourhood of such places. Control is difficult because the insect infests many other trees, including tea, cinchona, kapok, pepper, *Bixa orellana* (often used as a hedge plant in Java), tamarind, cinnamon and camphor. Catching the insects regularly by a special gang of women and children is practised in Java. A light bamboo 8 to 16 inches long, with a ring of bamboo at the end 3 or 4 inches in diameter, is used and this ring is covered with cobwebs or smeared with the adhesive sap of the jak tree; another method is to burn the insects with kerosene torches made from bamboo; many insects are thus destroyed, but neither method is really satisfactory. Spraying has not been very extensively tried, but the results so far are not encouraging. Insect enemies are few, but an ant, *Dolichoderus bituberculatus*, Mayr, has proved very useful in driving away this pest. The rind bug or cacao bark-sapper, *Sahlbergella singularis*, is the worst insect pest of cacao in the Cameroons, Gold Coast and Congo [see this *Review*, Ser. A, ii, pp. 141, 634, 670]. In Ecuador, the "mosquilla," probably a Phytocorid bug, causes very serious damage. Pods of all ages are attacked and the insect lives on them throughout its whole life. Few Lepidopterous caterpillars eat the leaves of cacao; in Surinam, the very young foliage is attacked by an unknown Geometrid and in Java the larvae of the Limacodids, *Orthocraspeda trima*, *Belippa lohor* and *Parasa lepida* feed on the leaves.

The cacao thrips (*Heliothrips rubrocinctus*) does great damage in Surinam and the West Indies by attacking the leaves and causing defoliation. In Surinam spraying with kerosene emulsion, tobacco decoction or Paris green was unsuccessful, but in Grenada kerosene emulsion is reported to have given good results. This thrips damages mangos (*Mangifera indica*), canary trees (*Canarium commune*), cashews (*Anacardium occidentale*), guavas (*Psidium guayava*) and will also live on Liberian coffee, apparently without doing much harm. The cacao moth, *Acrocercops* (*Zaratha*) *cramerella*, is perhaps the worst enemy of cacao; its life-history has been partially worked out by Zehntner; the eggs are laid in the furrows on the fruit and hatch in 6 or 7 days. The larvae begin to bore at once and, for from 15 to 18 days, live in the fruit and tunnel in the pulp; they then bore their way out and pupate, generally on the leaves, but sometimes on the fruits under a slight cocoon; the adult emerges in from 5 to 8 days. The method of control by "rampassing" is the only one which has been found of practical value [see this *Review*, Ser. A, i, pp. 57–62]. The reduction in the market value of cacao due to this pest is very serious; in one case 45 healthy fruits yielded 36 oz. of cacao of first quality, while the same number of attacked fruits only produced 12 oz. of second quality. *Ephestia elutella* (the chocolate moth) attacks the skin of the cacao bean in the West Indies, Ceylon and Java.

There is an excellent index to this book and the illustrations are well chosen.

[Other insect pests of cacao which are not mentioned by the author, include:—*Sahlbergella theobroma* and the grey moth borer,

Characoma stictigrapta, from the Gold Coast; a Psyllid, *Udamostigma tessmanni*, *Zonocerus variegatus*, *Trochalus carinatus*, *Metisa sierricola*, *Diacrisia maculosa*, *Earias citrina*, *Prodenia litura*, *Eulophonotus myrmeleon*, *Pseudococcus virgatus* var. *madagascariensis* and *P. citri* in Nigeria; *Helopeltis schoutedeni* in the Belgian Congo; *Ceratitis punctata*, *Stictococcus dimorphus*, *Adoretus hirtellus*, *Gryllotalpa africana* and *Gryllus gracilipes* in Uganda; *Ceratitis anonae* and *Polyrhabdotus transversalis* in German East Africa; *Arbela quadrinotata*, *Stauropus alternus*, *Eurydactylus sexspinosus* and *Cyclopelta siccifolia* in Ceylon; *Lachnosterna patens*, *Ligyrus ebenus* and *Nezara viridula* in the West Indies; *Horiola arcuata* and *Pseudococcus citri* in British Guiana; and *Tineopsis theobromae*, a pest of the stored bean, in the U.S.A.—Ed.]

van der Goot (P.). **Over de Biologie der Gramang-Mier** (*Plagiolepis longipes*, **Jerd**). [On the Biology of the Gramang Ant (*Plagiolepis longipes*, Jerd).]—*Meded. v. h. Proefst. Midden-Java, Salatiga*, no. 19, 1st June 1915, 60 pp. [Received 20th August 1915.]

This paper gives a detailed account of the life-history of *Plagiolepis longipes*, and deals at length with its relations with Aphids and Coccids. This ant is supposed to foster these pests as a source of food, and for that reason is itself to be regarded as a pest. It is said to construct covered ways on the branches of coffee over *Coccus* (*Lecanium*) *viridis* (green scale) and *Pseudococcus crotonis* (white scale), like those which are sometimes built by the black cacao ant (*Dolichoderus bituberculatus*), and to protect the scales by transporting them to suitable dwelling places. The author expresses doubt as to the truth of these statements. The black aphis, *Toxoptera aurantii*, Boyer, is the only Aphid of real consequence in hill farming in Java; it collects on the flower stalks and young twigs of cacao and also on young shoots of coffee, but is never associated with *Plagiolepis* or *Dolichoderus*. Coccidae only, especially the root frequenting forms, are sought after by ants in Java, particularly *Pseudococcus calceolariae*, Mask. The white lamtoro Coccid (*Pseudococcus bicaudatus*, Keuchenius) [see this *Review*, Ser. A, iii, p. 617], *P. crotonis* and *P. citri* are not transported by ants or at least only rarely. There is no positive evidence that any of the Lecaniinae or Diaspidinae are carried about by ants, and much to the contrary. Certain ants, such as the Argentine ant, *Iridomyrmex humilis*, and *Oecophylla smaragdina*, protect Coccids and Aphids by killing their natural insect enemies, but *Plagiolepis* appears to be quite helpless against the parasites and direct insect enemies of *Pseudococcus crotonis* or those of *C. viridis*. Nothing in the nature of symbiosis can be proved in the relations between various species of Java ants and *C. viridis*, but the possible effect of the ants on the rate of development of the Coccids is well worth further study. In coffee plantations the ants come to the Coccids, which are certainly not brought by them, so that the ants are only secondary pests and are in no sense productive of direct injury. There is no proof of direct damage to cacao, but it is possible that *Plagiolepis* drives away the black ant which has been found useful against *Helopeltis*. Trials of sodium arsenite and arsenate, corrosive sublimate, Paris green and lead arsenate for poisoning ants in the plantations gave no useful

results and more or less failed even in the laboratory. The most successful method and one which results in the catching of numbers of queen ants is the use of traps made of bamboo stuffed with dried leaves and laid about in the plantations under dead leaves and grass ; these traps work well in the rainy season. In order to obtain the best results, the dead leaves and other rubbish should be cleared away from under the trees so as to deprive the ants of other shelter. Another plan is to dig holes about 5 feet long by 2 feet wide and 8 inches deep at short intervals between the trees in the plantations ; these are filled with dry leaves and treated later with carbon bisulphide.

SCHOEVERS (T. A. C.). **Een Nieuwe Havervijand** (*Tarsonemus spirifex*, **Marchal), de Havermijt.** [A new Oat Pest, *Tarsonemus spirifex*, Marchal, the Oat Mite].—*Tijdschr. over Plantenziekten, Wageningen*, 1915, pp. 111–123, 2 figs., 3 plates.

In July, oats attacked by a species of *Tarsonemus* were received from Almkerk. Both larvae and adults appeared to agree with *Tarsonemus spirifex*, March. This identification was confirmed by Dr. Oudemans. Some of the oat plants examined had a very characteristic appearance. That part of the haulm which forms the rachis of the panicle extended little beyond the leaf-sheath, whilst the lowest branches of the panicle itself remained altogether in the leaf-sheath. The rachis both within and without the leaf-sheath, was twisted spirally like a corkscrew. This pest has done great damage in some departments of France and the attacked oats tillered very badly on poor dry soils. The one remaining haulm is strongly violet-coloured and the panicle remains almost entirely in the sheath and only the corkscrew-like stem, which forms the principal axis of the rachis, emerges. On soils of better quality some tillering takes place, and the violet colour of the upper haulms is not so marked. Kirchner recorded this oat mite in Wurtemburg in 1903, and his description of the effects of the attack does not altogether agree with that of Marchal, but this may possibly be explained by the fact that the oats examined by Marchal were attacked in an earlier stage of growth, and that in Wurtemburg winter oats were affected, whereas in France they were almost exclusively summer oats. The author's observations agree rather with those of Marchal than with those of Kirchner ; they were made at a later stage and the grain was fully developed though not quite ripe. On the experimental fields at Wageningen, which were seriously attacked, no examples were found of the condition described by Marchal in which the panicles remained in the sheath ; the twisting varied from a slight curve to a complete spiral, and cases were found which suggested attack by *Tylenchus* ; the violet colour was always on the leaf-sheath, never on the haulm ; the spikelets were constantly attacked and mites found within them, but in far smaller quantity than between the leaf-sheath and the haulm. *Tarsonemus spirifex* has also been found in Baden, Bavaria and Mecklenburg. The damage done is very considerable and at Wageningen 90 per cent. of the haulms were more or less attacked ; healthy plants were found exclusively on the borders of the fields and they possibly escaped or survived attack by having more room for growth. A field of "evene" next to the oats was

entirely free from the pest, but a few oat plants among it were attacked; thus apparently "evene" is immune. The damage in Almkerk was very serious, but the land was in a bad condition. In France the damage done in different years on various soils is very variable; according to Guille, it is not uncommon in some years to find fields in which every plant is attacked and the yield reduced to 25 per cent. or even nothing. *Tarsonemus spirifex* appears to prefer oats to all other grain; Marchal records it on a few wheat ears, and Guille occasionally on barley; Kirchner regards barley as immune; it has not yet been found on rye. The sudden appearance of the mites cannot be explained until more is known as to how and where this pest passes the winter; this may be as fully developed mites or as larvae in the soil. According to Kirchner, Guille and Schneider, oats following oats were more than ordinarily attacked, and this is borne out in the experimental fields at Wageningen, on which oats have been grown continuously for nine years. Guille thinks that the mites migrate to wild grasses after the oats have been cut; another possibility is that eggs remain in the spikelet and are sown with the seed; but the author regards it as more than probable that grasses allied to oats are also food-plants and that they resist attack better than oats. Helping the plants over the critical time seems to be the only method of combating the pest. This can be done by a dressing of nitrate of soda. Proper rotation of crops, correct preparation and manuring of the soil, and early sowing should also be of use, in that the plants will be in a better condition to resist attack. It has been noticed in France that oats suffer most on soils subject to drought, not merely want of rain but want of power to retain moisture. At Wageningen the months of May and June were remarkably dry, and had the oats been sown earlier, they would have obtained a better and larger root-hold to enable them to stand the want of water. Wet weather is inimical to the mites directly, and indirectly favours the growth of a fungus which attacks and kills them. This fungus has not been determined, but it greatly resembles *Cordyceps clavulata*, Ellis.

A description of the mite and larvae with plates by Dr. A. C. Oudemans forms a supplement to this paper.

TRINCHIERI (G.). **La "Tortrice Buoliana"** (*Evetria buoliana*).— Reprint from *Bulletino A.O.P.I., Sanremo* [?], iii, no. 7, July 1915, 7 pp.

In consequence of the recent United States quarantine measure prohibiting the importation of pines of European origin [see this *Review*, Ser. A, iii, p. 519], this paper has been prepared in order to give, in a popular form, information regarding *Rhyacionia* (*Evetria*) *buoliana* (European pine-shoot moth). The 15 works mentioned in the bibliography include the two recent papers by Busck [see this *Review*, Ser. A, ii, p. 701; iii, p. 376].

SCARIOLI (D. G.). **Gli Afidi.** [Aphids.]—*Venezia Agricola*, Venice, xviii, no. 32, 8th August 1915, p. 3.

Injections of potassium cyanide are ineffective against Aphid attack [see this *Review*, Ser. A, iii, p. 73] as the insects only refrain from infesting those portions of the plant which are perishing through the

action of the poison. There is evidence that the poison does not circulate in the sap, but that it only kills the plant cells with which it comes in contact. According to Franceschini, silkworms fed on leaves taken from a mulberry treated with potassium cyanide were quite unaffected.

W. N[OWELL]. **The Internal Disease of Cotton Bolls.**—*Agric. News, Barbados*, xiv, no. 345, 17th July 1915, pp. 238–239.

The internal disease of cotton-bolls may be connected with the presence of cotton stainers. While staining may be initiated by matter issuing from punctures in the young seeds made by the insects, it depends for its extension on infection with an organism, which, in the majority of cases, appears to be a specific fungus, and in others bacteria or other fungi.

The Shot-hole Borer of Tea.—*Trop. Agric., Peradeniya*, xlv, no. 1, July 1915, pp. 55–59.

According to Speyer, the adult female of *Xyleborus* (*Anisandrus*) *fornicatus*, Eichh. (shot-hole borer of tea), having completed the entrance gallery and the first spiral gallery, deposits from 2 to 5 eggs in the second spiral—a gallery which is subject to infinite variation in length and direction. When this gallery is completed and the eggs deposited, borings of a different nature from those of the previous ones are seen to be ejected through the entrance hole. These borings are the result of the tearing away of the pith of the stem, and mark the beginning of one of the longitudinal galleries, usually the one which passes downwards through the pith. The time occupied in making the second spiral in which the eggs are laid, and that which elapses before beginning the first longitudinal pith gallery, is dependent on the rate of the maturation and development of the egg in the body of the parent. Should these periods be well advanced, the egg-gallery will be short; in abnormal cases, the longitudinal gallery is constructed before the eggs are laid. From the time that the gallery is begun up to the laying of the first mass of eggs, no male beetle enters the gallery.

As neither the larva nor the adult actually feeds upon any part of the tea-plant, the use of sprays or chemical salts will give no result in control. When boring into the stem, the female beetle does not swallow the borings, but ejects them without their passing into any part of the alimentary tract. The information gained concerning the life-history of this insect has been obtained in two different ways. In the first, glass tubing was fixed over shot-holes in tea plants, and an apparatus devised to provide suitable ventilation without any possibility of escape for emerging beetles or material. This complex method can only be applied to a comparatively small number of individual beetles and galleries, so that little knowledge can be gained of the entrance and emergence of the beetles from the galleries, which is the first piece of information essential to the determination of control schemes. The second method consisted in the choosing of an area of plantation which contained 256 tea plants, of which 91 were, or had been, attacked on or before 24th April. Every branch attacked was

cut out from its base on that date, and, between 4th and 8th May, the trees were again examined, those previously attacked having been marked. On 8th May, 78 trees had been attacked again, of which 20 had not been infested previously and 58 had been infested before 24th April. The remaining 33 trees which had been attacked before 24th April were not attacked again. Some of the trees from which the shot-hole had been eradicated on 24th April had only one branch left, so that the possible area of attack was considerably lessened, making the number of trees re-attacked still more prominent. This simple experiment has yielded the following results, which have since been confirmed :—(1) An emergence of the beetle took place from the surrounding infested tea between 24th April and 8th May. (2) During the wet season, there is considerable activity on the part of the insect. (3) Trees attacked once, are highly liable to further attack. (4) An invasion of the beetle will infest trees not previously attacked. (5) To leave one branch on a tree unpruned—a suggestion which is current for the control of the borer in the pruning season—courts the increase, rather than the decrease, of the beetle. In conclusion, Mr. Speyer laid emphasis on the fact that the extermination of the pest is a matter for urgent and pressing haste.

Hopkins (A. D.). **A New Genus of Scolytoid Beetles.**—*Jl. Washington Acad. Sciences, Washington, D.C.*, v, no. 12, 19th June 1915, pp. 429–433.

This paper describes a new Scolytid genus, *Conophthorus*, Hopk., and contains a key to a number of new species. These beetles inhabit the young cones and, in rare cases, the twigs and shoots of different species of *Pinus*. *Pinus ponderosa* and *P. lambertiana* on the Pacific Slope [see below], *P. strobus* in the Eastern States and *P. scopulorum* in the Rocky Mountain region are chiefly attacked.

Miller (J. M.). **Cone Beetles: Injury to Sugar Pine and Western Yellow Pine.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 243, 24th July 1915, 12 pp., 5 plates.

Injury distinguished by the dying of immature cones soon after the starting of the second year's growth and termed "blighted cones" occurs frequently in the seed crops of sugar pine (*Pinus lambertiana*) in California and Oregon, and of western yellow pine (*Pinus ponderosa*) in the Pacific coast and southern Rocky Mountain regions. The greater part of this damage is caused by the Scolytids, *Conophthorus lambertianae*, Hopk. (sugar-pine cone beetle), and *C. ponderosae*, Hopk. (western yellow-pine cone beetle). Their life-history and the damage caused by them are entirely connected with the cones of the host trees. The adults bore a small tunnel through the axis of the cone, in which the eggs are deposited. The larvae feed upon the scales, seeds and tissues of the withering cone, the pupae being formed within the same cone as that in which the larvae develop, and the adults hibernate in it. The emergence of the adults of *C. lambertianae* takes place early in May. From the end of May to the end of June the second-year cones are attacked and the eggs are deposited. From the beginning of July to the end of August, new adults arise and the cones fall from

the trees. The overwintering period of the adults in fallen cones extends from early in August to 1st April. In the case of *C. ponderosae*, only a few of the injured cones of the yellow pine fall, so that the overwintering adults are to be found in cones upon the trees. The damage done by *C. ponderosae* to yellow pine has never been noted to be as extensive as that of *C. lambertianae* to sugar pine. The latter pest destroyed 75 per cent. of the sugar pine seedling crop on one area observed in 1914. These beetles are a menace to the natural or artificial reproduction of the host-tree when the virgin forest has been destroyed by timber cutting, fire, or epidemic insect infestations. Yellow pine and sugar pine are two of the most valuable timber trees, and where the required supply of seed is delayed, there is a risk of the ground being usurped by less valuable trees. As all the infestation from the end of August until the following May will consist of adults which are hibernating in the cones, it is evident that, if all fallen cones can be collected and burnt during that time, a very appreciable reduction of the infestation and damage may result. In the case of sugar pines, all infested cones will be found on the ground and burning will not entail great expense. By 18th July, or a little earlier in some situations, the attacked cones begin to stand out conspicuously and seed collectors are in a position to determine whether or not the seed crop of the current year can be profitably collected.

Mosher (F. H.). **Food Plants of the Gipsy Moth in America.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 250, 24th July 1915, 39 pp., 6 plates.

This bulletin reports a series of investigations conducted in 1912, 1913 and 1914 to determine the favoured food-plants of the gipsy moth [*Lymantria dispar*]. The trees and shrubs tested have been classified in the following four groups :—

I. Species which are favoured food-plants : Speckled alder, apple, mountain ash, American aspen, large-toothed aspen, balm-of-Gilead, American beech, grey birch, paper birch, red birch, blueberry box elder, red gum, hawthorn, hazelnut, beaked hazelnut, American larch, European larch, American linden, European linden, black oak, rock chestnut oak, dwarf chestnut oak, bur oak, pin oak, post oak, red oak, scarlet oak, bear oak, shingle oak, swamp white oak, white oak, lombardy poplar, pasture rose, service-berry, mountain sumac, scarlet sumac, staghorn sumac, white willow, glaucous willow, sandbar willow, witch-hazel.

II. Species which are favoured food after the earlier larval stages : Chestnut, hemlock, pitch pine red pine, scotch pine, jack pine, western white pine, white pine, beach plum, black spruce, Norway spruce, red spruce, white spruce.

III. Species which are not particularly favoured, but upon which a small proportion of the larvae may develop : European barberry, bayberry, black birch, yellow birch, low blueberry, tall blueberry, sweet cherry, wild black cherry, wild red cherry, chokeberry, choke cherry, cottonwood, American cranberry, American elm, European elm, slippery elm, sweet fern, sweet gale, black gum, bitternut hickory, mockernut hickory, pignut hickory, shagbark hickory, American hornbeam, hop hornbeam, Norway maple, red maple, silver maple, sugar maple, pear, silver poplar, sassafras.

IV. Species which are not favoured: Arbor vitae, arrow-wood, maple-leaved arrow-wood, black ash, blue ash, red ash, white ash, white and flame azalea, fir balsam, high blackberry, larger blue-flag, butternut, hardy catalpa, red cedar, southern white cedar, cornus, cranberry-tree, red currant, bald cypress, dangleberry, narrow dock, flowering dogwood, American elder, swamp eubotrys, feverbush, grape, green brier, hackberry, pink hardhack, white hardhack, American white holly, bush honeysuckle, highbush huckleberry, inkberry, poison ivy, common juniper, Kentucky coffee tree, mountain laurel, sheep laurel, black locust, honey locust, mountain maple, striped maple, red mulberry, white mulberry, Osage orange, red osier, pepperbush, persimmon, privet, raspberry, sarsaparilla, skunk cabbage, spice-bush, sweet brier, sweet pepper-bush, sycamore, Appalachian tea, tulip-tree, sweet viburnum, black walnut, bay-leaved willow, smooth winterberry.

The species noted in Class I. are at present dominant in the woodlands in the area now infested with the gipsy moth. The oaks and birches predominate over much of this area, and this increases the difficulty of improving the situation. Most of the species of high commercial value are included in Classes I. and II. In arranging combinations which will resist moth attack it is necessary to consider the soil and other conditions suitable for their successful growth and to endeavour to bring about replacements cheaply. The encouragement of coniferous growth is to be commended, provided the Class I. trees can be eliminated. Experimental work with different stands of forest growth is being conducted by Mr. G. E. Clement of the U.S. Bureau of Entomology, and practical advice is being given. In addition to forest trees and shrubs, plants of much importance to horticulture and for ornamental and city planting are included in the above lists. The apple is the horticultural crop most likely to be affected. The usual controls are briefly mentioned. Cases of severe injury to cranberries were observed in 1914 and the pecuniary loss is likely to be serious. In cities and parks, or on street or shade trees, the control of the gipsy moth requires large expenditure if the species favourable to the insect are to remain. When future plantings are made, other species should be selected and the lists given will furnish a guide in this respect. An index of the food-plants used in the experiments, both the scientific and popular names being given, is appended.

Brunner (J.). **Douglas Fir Pitch Moth.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 255, 22nd July 1915, 23 pp., 10 figs.

Investigation has made it evident that the larva of *Aegeria* (*Sesia*) *novaroensis*, Hy. Edw., (Douglas fir pitch moth) is the primary cause of a large percentage of the depreciation in value of the timber of *Pseudotsuga taxifolia* (Douglas fir). This amounts to at least 90 per cent. in the northern Rocky Mountain and Pacific coast regions, and the loss is similar in the southern Rocky Mountain district. In one saw-mill, £3,800 represented one season's loss. In the spring of 1913, an investigation was begun regarding the habits of insects affecting th· growth and development of trees, and information was gained concerning the larval stages, etc., of this moth; in the field, their incubation period is about two weeks. With the exception of the dark brown head, the larva is white; the darker intestines and their

contents are visible through the transparent skin, thus differing from *Vespamima sequoiae*, Hy. Edw., which also infests Douglas fir to a slight extent. This internal dark spot is especially noticeable in one and two-year-old larvae. Pupation takes place in the third season. At high altitudes, an extension of the larval period into the fourth year may occur. In the laboratory the pupal period was 30 days. The general emergence of the moth occurs in June, though some individuals appear as early as the 1st of May and others as late as the beginning of August. The imago lives only about five days after emergence, which accounts for its scarcity. Where there is an abundance of suitable trees for infestation, the female appears to deposit one egg only on each, and thus a number of trees are affected by a single female. Where the insect is abundant, as many as 6 larvae, all of the same generation, have occurred on a single tree. By 1st August, the young larvae from eggs laid in June, may be readily located by the boring dust which resembles that of *Dendroctonus pseudotsugae*, Hopk. At the end of the first active season, a pitch tube covers the wound as well as the larva which made it. During the second season the larva merely maintains and enlarges the tunnel or chamber and it appears to moult for the first time when 1 year old. The third season is passed like the second, the larva again moulting when 2 years old. By the end of this period, the covering pitch-tube is about the size of an American silver dollar. In the third spring the larva is ready to pupate, the adult appearing exactly 3 years after the egg was laid. Although there are no seasons in which this insect is very abundant, there are none in which it is unusually scarce. Unlike others of this group, this insect prefers the shade and is most numerous in from 10- to 50-year-old Douglas firs in spots with a northerly exposure. Larvae under pitch-tubes which are much exposed to the sun, are almost invariably killed during the winter months, as they cannot survive when kept active by warmth, while their food is cut off by frost. A simple and reliable method of ascertaining the localities where this pest is numerous consists of watching the logs at a mill as they go through the saw and noting the areas from which those with pitch seams came. The range of this moth probably extends through the entire native range of the Douglas fir. It also breeds and thrives in wounds on *Larix occidentalis* (larch), particularly in the pitch flow caused by the fungus, *Trametes pini*. Larch is not, however, successfully attacked if previously uninjured. The healthier and quicker growing a Douglas fir is, the more it appears to be subject to infestation. Trees are first attacked when 10 years old and are practically immune after they are 50 years old, owing to the bark roughening and thickening. In dealing with the relation of *Aegeria novaroensis* to other destructive insects, beetles of the genera *Melanophila*, *Tetropium*, etc., are stated to have acted as agents in preparing favourable propagating places for the moth. The rare instances of inter-relation between the latter and *Scolytus unispinosus* seem of no economic importance. *Vespamima sequoia*, also infests Douglas fir [see this *Review*, Ser. A, ii, p. 645], especially in old wounds made by *A. novaroensis*, thus extending the injury. Wounds in Douglas fir, particularly those made by the pitch moth, are usually infested for several seasons by the larvae of a small species of *Laspeyresia*. In localities where *A. novaroensis* is more than usually numerous, nearly

20 per cent. of its larvae are killed before reaching maturity by a Tachinid, but only those larvae which are under imperfect pitch tubes are parasitised, so that the economic value of this parasite is practically nil. On account of the long life-cycle of this pest, its elimination will follow in any country where forests are properly cared for. The isolation of areas susceptible to infestation should be the main control measure. A watershed, one side of which is always subject to a greater degree of sunlight than is favourable to this insect, or a sufficiently wide belt of trees other than Douglas fir on the opposite side of a stream, may entail the separation of such an area from neighbouring ones. Small tracts which can be given attention for a few days annually, may be kept comparatively free, and even if infested, the removal of the larvae during the first year will prevent the development of serious wounds. Destruction of the larva is the only remedy that can be used to reduce an infestation. When the infested pitch tube is found, it should be separated from the tree, and the exposed larva killed; to insure cleaner healing, the ragged edges of the wound should be smoothed and painted with creosote. Freshly vacated wounds may be treated in the same way. One experienced man can clean and keep clean an area 50 miles square (roughly, 1,600,000 acres) in the course of a few years. A bibliography of five works concludes this paper.

BROOKS (F. E.). **The Parandra Borer as an Orchard Enemy.** *U.S. Dept. Agric. Washington, D.C.*, Bull. no. 262, 19th July 1915, 7 pp., 4 plates.

Parandra brunnea, F., which has been popularly called the ash root-borer, chestnut telephone-pole borer and heartwood borer, is a very general feeder, attacking the live and dead heartwood and sapwood of a great variety of trees, including pine, black walnut, hickory, willow, beech, chestnut, chinquapin, oak, elm, tulip, apple, pear, plum, wild and cultivated cherry, locust, *Ailanthus*, soft maple, basswood and black ash. It occurs over the greater part of temperate North America. *P. brunnea* is a borer from which trees are in very little danger of injury so long as they are in vigorous condition. It enters the wood from dead or decaying places on the surface and is probably never found in trees whose trunks and larger branches are entirely covered with healthy bark. Any primary injury, including those by *Chrysobothris femorata*, F. (flatheaded borers), and *Saperda candida*, F. (roundheaded borers), may result in attacks by *P. brunnea*, which inserts its eggs into the surface wood of the dead spots whence the larvae extend their burrows. Mining proceeds for a period of probably three years, the galleries being extended upward more frequently than downward. Pupation takes places within the wood, the beetles working their way out through the larval galleries. They frequently return to the dead wood, and hide in the old galleries. Eggs are now inserted into the wood which forms the walls of the old burrows, and the borers of the new brood penetrate still farther into the wood. The work of *P. brunnea* may be distinguished from that of *S. candida* by the fact that the former enters at a dead spot and throws no castings to the surface, whereas the latter enters living wood and freely extrudes reddish yellow castings, which form small heaps at the

base of the tree. The adult is on the wing in July and August. The Ichneumonid parasite, *Odontomerus mellipes*, Say, infests *P. brunnea* in West Virginia and the adult beetle has been found in the stomach of *Nuttallornis borealis* (olive-sided flycatcher). The best method of preventing injury by this pest is the keeping of trees in such a condition that the beetle will not oviposit in them. Any injury to the trunks and larger branches should have attention. Winter injuries and diseases are less easily preventable, but, where these are present, the pest may be kept out temporarily at least by a liberal use of paint applied to the dead surfaces in the spring or early summer. When the borers have gained entrance, the only practicable way of removing them is to chisel out all the wood through which their burrows extend ; the cavity is then carefully cleaned, sterilised with creosote, painted with a heavy coat of coal-tar and filled with cement.

Scammell (H. B.). **The Cranberry Rootworm.**—*U.S. Dept. Agric. Washington, D.C.*, Bull. no. 263, 19th July 1915, 8 pp., 2 plates.

The Chrysomelid, *Rhabdopterus picipes*, Oliv., (cranberry rootworm) is widely disseminated throughout the United States and is also reported from Canada. It has recently been found in a number of cranberry bogs in New Jersey. The adult beetle has been found on myrtle, basswood, wild grape, cranberry, blueberry and inkberry ; its larvae are abundant on the roots of the cranberry, though two years' observation has shown that the injury caused is not of prime importance and not comparable in severity with that caused by *Crambus hortuellus*, Hb. (cranberry girdler), to which insect the injury produced by *R. picipes* has probably heretofore been attributed. The chief harm is caused by the feeding of the larvae upon the roots and runners, where the latter come in contact with the ground. As a rule, only the bark is eaten from the large secondary roots, while the fibrous roots, which are very numerous, are completely devoured. Generally the rootworm feeds in the soil, while the girdler feeds on the surface. The plants which suffer most are those on sandy land. Where the roots are severely injured, the leaves wither and turn red or brown. Small areas which are thus killed out, are almost invariably at the margin of the bogs or on relatively high and sandy areas in the interior of them. The mud and peat bottoms rarely suffer. The various stages of the insect are described. The emergence of the adults from the soil begins about mid-June. The egg-stage varies from 6 to 11 days. The small larvae feed on the fibrous roots near the surface. They may be found feeding at all times during the summer and until quite late in the autumn, at which time some of them go deeper into the ground. When feeding ceases, a round cell is formed in the soil within which the larva hibernates until spring. If the bog is flooded during the winter, the larvae remain dormant, at least until the flood is drawn in spring, when feeding is resumed. *R. picipes* spends most of its life in the larval stage, approximately 10 months. The time when pupation commences varies somewhat with the management of the bog ; the earlier the flood is drawn off, the earlier will be the date of general pupation. The average duration of the pupal stage was found to be $14\frac{1}{2}$ days, and from 2 to 3 days were spent by the adult hardening in the cell and reaching the surface. Winter flooding or spring

reflooding have not proved satisfactory in controlling the larvae and pupae. Carbon bisulphide proved ineffective. The addition of an arsenical to the customary Bordeaux and resin-fish-oil soap used against the fungus diseases of the cranberry is of value in killing the beetles which feed on the foliage. Owing to the dangerous nature of arsenite of lime, lead arsenate is recommended for general use; a suitable formula contains 3 lb. of paste lead arsenate to 50 U.S. gallons of water or Bordeaux mixture. Excellent results are obtained by invigorating the cranberry vines by the application of fertilisers or a one-inch coat of sand. A bibliography of 8 works is appended.

Levison (J. J.). **Ornamental and Shade Trees.**—*American Forestry, Washington, D.C.*, xxi, no. 260, August 1915, pp. 861–865, 4 figs.

The following advice is given for the month of August: (1) Spraying with whale-oil soap 1 lb. in 5 U.S. gals. water, for Aphids on beech, white pine, fruit trees and elm; (2) destruction of the pupae of the elm leaf beetle [*Galerucella luteola*], either with hot water or kerosene emulsion applied at the base of the tree; (3) the removal of cocoons and egg-masses of the tussock moth [*Hemerocampa*]; (4) spraying with arsenate of lead, 1 lb. to 10 gals. water, for the destruction of the locust miner [*Cyllene robiniae*], on black locust, oak, linden and fruit trees; (5) removal of branches of white pine infested by white pine weevil [*Pissodes strobi*]; (6) the fumigation with carbon bisulphide or mechanical removal of borers in peach, oak or maple, the presence of which is indicated by the exudation of gum.

The hickory bark borer [*Scolytus quadrispinosus*] has been very noticeable in 1915 as far west as Buffalo. The forest tent caterpillar [*Malacosoma disstria*] has been very destructive in Long Island, Pennsylvania and New York States. A serious invasion of army-worm [*Cirphis unipuncta*] was reported from Cecil county.

Philips (W. J.). **Further Studies of the Embryology of *Toxoptera graminum*.**—*Jl. Agric. Research, Washington, D.C.*, iv, no. 5, August 1915, pp. 403–404, 2 plates.

This paper gives a description of the development of the winter egg of *Toxoptera graminum*, Rond., based on material observed during the winter 1911–12.

Jones (T. H.). **Aphides or Plant-Lice attacking Sugar-cane in Porto Rico.**—*Govt. of Porto Rico, Bd. Commissioners Agric., Rio Piedras, P.R.*, Bull. no. 11, 15th March 1915, 19 pp., 2 figs. [Received 30th August 1915.]

Two species of Aphids are known to attack sugar-cane in Porto Rico. Of these, *Sipha flava*, Forbes (yellow sugar-cane aphis) is of chief importance, the other, *Aphis setariae*, Thos. (brown sugar-cane aphis), being uncommon. *S. flava* is known in the United States as a

pest of various grasses. In Porto Rico, it has also been found to attack sorghum and lemon grass. *A. setariae* occurs only on sugar-cane. In the field, both species are present in small colonies composed of winged and wingless forms. Colonies of *S. flava* occur on the under-side of the leaves, those of *A. setariae* at the junction of the leaf and leaf-sheath, on the lower surface and on either side of the midrib. Both species are attended by ants ; in the case of *A. setariae* earthen shelters are constructed round the colony by the ants. *S. flava* is attacked by a fungus, *Acrostalagmus albus*, Preuss. ; by five Coccinellids, viz., *Cycloneda sanguinea*, L., *Megilla innotata*, Muls., *Scymnus roseicollis*, Muls., *S. loewii*, Muls., and *Hyperaspis* sp. ; by a Syrphid fly, a new species of *Ocyptamus* ; and by a lace-winged fly, *Chrysopa collaris*, Schm. The fungus apparently plays an important part as a natural enemy. *M. innotata* and *C. sanguinea* feed on the larval and adult stages of *S. flava*. Both species are parasitised by a Chalcid, *Homalotylus obscurus*, which is itself attacked by an undetermined parasite. The larva of the *Ocyptamus* feeds on the Aphid ; from 6 to 8 days are required for the larval stage and 6 or 7 for the pupal period of this fly. *A. setariae* is attacked by *S. roseicollis*, by the larva of a Syrphid fly and by an internal parasite, a Braconid, *Lysiphlebus testaceipes*, Cress. Owing to the effectiveness of their natural enemies the use of artificial measures of control against these Aphids is inadvisable, especially as the difficulty and cost of applying satisfactory remedies are considerable.

JONES (T. H.). **The Sugar Cane Moth Stalk-Borer** (*Diatraea saccharalis*, **Fabr.**)—*Govt. of Porto Rico, Bd. Commissioners Agric., Rio Piedras, P.R.*, Bull. no. 12, 16th March 1915, 30 pp., 8 figs. [Received 30th August 1915.]

Diatraea saccharalis is at present known as an enemy of sugar-cane in the tropical and sub-tropical parts of the Western Hemisphere. In Porto Rico, maize, *Panicum barbinode* (Para grass) and *Hymenachene amplexicaule*, as well as sugar-cane, are attacked. The eggs are laid in clusters on either surface of the leaf. The larvae hatch in 5 days and make their way to the central whorl of leaves ; in later stages they work down into the stem of the cane. The larval stage lasts from 20 to 30 days. Pupation takes place in the tunnel formed by the larva. Two parasites of *D. saccharalis* which occur in Porto Rico are *Trichogramma minutum*, Riley, and a Tachinid, *Hypostena* sp., while the fungus, *Cordyceps barberi*, Giard, attacks the larva and pupa. No predaceous enemies have been recorded. The best methods of control are :—(1) Planting of non-infested seed ; (2) the simultaneous planting and harvesting of large areas ; and (3) clean cultivation, both before and after planting. [See this *Review*, Ser. A, ii, pp. 58 and 279.] The use of lights as a means of capturing adults does not seem advisable. At the time of harvesting, all stalks cut in the field should be taken to the mill and ground in order to destroy the larvae and pupae. Attempts will be made to introduce enemies of this pest from other countries, beginning with those occurring in Trinidad and Demerara. A bibliography is appended.

LYLE (G. T.). *Coenopachys hartigii*, **Ratz. (Braconidae), a Genus and Species new to Britain.**—*Entomologist, London*, xlviii, no. 628, September 1915, pp. 212–213.

Coenopachys hartigii, Ratz., was bred together with *Hypophloeus linearis*, F., obtained from the burrows of *Ips bidentatus*, Hbst. (*Tomicus bidens*, F.), in fallen branches of *Pinus sylvestris*. According to Ratzeburg, this insect has been bred from *Oecophora* (*Harpella*) *geoffroyella*, but Marshall records the former host. The first specimen emerged on 15th April, the last on 16th June. The dead twigs, etc., from which the insects were bred, yielded 2 empty cocoons, which were firmly fixed in the burrows of *I. bidentatus*

GIRAULT (A. A.). **Notes on two South American parasitic Hymenoptera.**—*Entomologist, London*, xlviii, no. 628, September 1915, pp. 213–214.

The following species of parasitic Hymenoptera from British Guiana are described : *Eupelmus koebelei*, Ashmead, reared from Dipterous larvae found in the stem of *Anatherum bicorne*, and *Baeus auraticeps*, sp. n., reared from the egg-sac of a spider.

GIRAULT (A. A.). **Two new British Chalcidoid Hymenoptera, with Notes.**—*Entomologist, London*, xlviii, no. 628, September 1915, pp. 217–218.

The following new species of Chalcidoid Hymenoptera are described : *Coccophagus brittanicus*, sp. n. ; *Apidencyrtus aspidioti*, Girault, *britannicus*, var. n., and *Apterotrix longiclava*, sp. n., both reared from *Lepidosaphes ulmi*. *Coccophagus niger*, Masi, *Phycus testaceus*, Masi, and *Aphelinus mytilaspidis*, Le Baron, were reared at the same time.

LEFROY (H. M.). **The Control of White Fly and Soft Scale.**—*Gardeners' Chronicle, London*, lviii, no. 1497, 4th September 1915, p. 154.

In August 1914, figs at the Royal Horticultural Society's Gardens, Wisley, were found to be attacked by *Coccus* (*Lecanium*) *hesperidum* (soft scale). Other scales infested with a parasite were introduced and the parasite established. In 1915, the scale, though present in small numbers, has done no material damage. For over 2 years white fly (*Aleurodes*) has been bred under control and recently a parasite of the scale stage has been discovered. This parasite has multiplied rapidly at Wisley and is available for distribution to infested greenhouses.

LEFROY (H. M.). **On keeping Orchards clean.**—*Jl. R. Hortic. Soc., London*, xli, no. 1, August 1915, pp. 28–39, 8 figs.

This paper gives a summary of the common pests of fruit trees and deals especially with the hibernating stages. The following recommendations are given for their control : (1) The clearing away of

rubbish such as fallen leaves, pea-sticks, leaf-mould, etc. ; (2) digging in of grass to prevent the hibernation of the apple-leaf miner moth [*Lyonetia clerkella*], pear midge larvae [*Contarinia pyrivora*], leaf-hoppers, weevils, etc. ; (3) the use of open fences or open hedges and clean ditches ; (4) the removal or burning of dead wood and prunings ; (5) the removal of soft shoots which may harbour the woolly aphis [*Eriosoma lanigerum*], on apple and the grey pear aphis ; (6) the tarring of the ends of pruned branches ; (7) the use of a suitable winter wash to remove moss and lichens which would shelter insects and to kill larvae wintering in the bark ; (8) the control of wild food-plants, the most important of which are hawthorn, sloe, willow, poplar, oak, cotoneaster and rose ; (9) a summer spraying sequence ; (10) the practice of grease-banding for winter moth [*Cheimatobia brumata*], and bands of cloth or sacking for codling moth [*Cydia pomonella*] ; (11) the removal of "windfalls."

For apple, four sprayings are desirable ; (1) in April with an apple-sucker wash ; (2) with lead chromate as soon as the foliage is formed ; (3) with a contact poison in June ; if mussel scale [*Lepidosaphes ulmi*] is present a strong wash should be applied to trunk and foliage ; and (4) with a strong contact poison in September. For pear, the following measures are recommended : (1) Lead chromate as soon as the foliage is formed and (2) a contact poison for leaf-curling Aphids ; for cherry, (1) lead chromate as soon as foliage is formed and (2) contact poison in autumn if black fly [*Aphis rumicis*] is seen ; for plum, the same as for pear ; for currant, (1) sulphur and contact poison for gall mite [*Eriophyes ribis*] in May and (2) contact poison in June, July or August for Aphids, white scale [*Chionaspis citri*] or brown scale [*Saissetia hemisphaerica*] ; for gooseberry, (1) lead chromate as soon as foliage is formed and (2) sulphur and contact poison for red spider in April or May.

A. C. F. **Weevil attack on Foliage of Young Larch.**—*Qtrly. Jl. Forestry, London*, ix. no. 3, July 1915, pp. 259–260.

During the springs of 1914 and 1915, a number of recently planted young larches have been attacked by weevils on two of the Department's forestry centres in Ireland, at Ballykelly, Co. Derry, and Dundrum, Co. Tipperary, while a similar attack has just been reported in Co. Antrim. The needles are eaten off as soon as they appear by several species of weevil. This attack was probably due to the fact that the broad-leaved species which, under ordinary circumstances, are attacked by these weevils, were not sufficiently far advanced when the larches first came into leaf. On well established plants the damage is not of great importance, but when recently transplanted trees are attacked, it is often considerable. The attacks of these weevils upon larch do not appear to have been previously noticed, and probably depend a good deal upon the nature of the season. The species concerned were :—*Phyllobius argentatus* and *P. maculicornis*, two of the green leaf weevils which live on the leaves of hardwoods ; *Otiorrhynchus picipes*, the raspberry weevil, which gnaws through the young shoots of raspberries ; *Strophosomus coryli*, which

attacks the leaves of hazel and other plants; and the Scolytid, *Myelophilus* (*Hylesinus*) *piniperda*, which is very destructive to the shoots of Scots pine, and has been recorded on larch.

MUNRO (J. W.). **The Larvae of the Furniture Beetles—Families Anobiidae and Lyctidae.** *Proc. R. Phys. Soc., Edinburgh*, xix, no. 8, September 1915, pp. 220–230, 8 figs.

There are four species of ANOBIIDAE, which are more or less common in buildings, namely, *Anobium domesticum*, Fourc., *A. paniceum*, L., *Xestobium tessellatum*, L., and *Ptilinus pectinicornis*, L.; a fifth species, *Ernobius mollis*, L., occurs in Aberdeenshire. Both *Lyctus linearis*, Goeze (*canaliculatus*, F.), and *L. brunneus*, Steph., bore in stored timber. The larva of *A. domesticum* was obtained from beech panelling, a willow basket-work mat and rough boarding. *E. mollis* was found in larch paling posts. *A. paniceum* was received in dog biscuits and *P. pectinicornis* from a piece of furniture.

BALLARD (E.). **An Erotylid Grub in Thenai at the Central Farm, Coimbatore.**—*Agr. Jl. India, Calcutta*, x, no. 3, July 1915, pp. 302–303. [Received 10th September 1915.]

In December 1914, dead-hearts were noticed in thenai (*Setaria italica*) growing in the insectary at Coimbatore. This was due to the presence of the larva of an Erotylid beetle (? *Fatua* sp.). Larvae, pupae and eggs were found in different stems and adults were reared. The eggs are laid singly about half-way up the stem, generally just above a node, in a hole cut through the leaf sheath and stem. The larva first bores its way up the stem for some distance, then returns for pupation to the place where the eggs were laid. Before pupation, the larva prepares for the emergence of the adult by ringing the stem for about $\frac{3}{4}$ of the circumference inside, and consequently the stem readily breaks at this point. The insect is kept in check by an Ichneumon and a Chalcid, parasitic in the larvae. The pupa of the Ichneumon is generally found about half way up the internode in which the Erotylid larva has been burrowing.

HEWITT (C. Gordon). **Two serious Fruit Pests new to Canada.**—*Agric. Gaz. Canada, Ottawa*, ii, no. 8, August 1915, pp. 732–737, 4 figs.

Early in April 1915, Mr. R. C. Treherne discovered an infestation of *Eriophyes ribis*, Nal., near Duncans, British Columbia, and at the end of the same month he received specimens of *Taeniothrips pyri*, Daniel, (pear thrips) from a locality near Victoria. Although *E. ribis* had occasionally been found on imported currant bushes, this is the first record of its being found established in Canada. *T. pyri* is one of the most important pests in the San Francisco Bay region and the fact that it is injurious in the State of New York is strong evidence of its ability to become a serious pest in British Columbia if immediate control measures are not undertaken.

Brittain (W. H.). **Report of the Professor of Zoology and Provincial Entomologist.**—*Ann. Rept. Secretary for Agriculture, Nova Scotia, for the year 1914, Halifax, N.S.*, 1915, pp. 28–51. [Received 1st September 1915.]

In 1914, there was a marked outbreak of *Cirphis* (*Heliophila*) *unipuncta* (army worm) in practically every part of Nova Scotia. *Hydroecia micacea* (stalk borer) damaged many potato plants and destroyed the rhubarb crop at the Nova Scotia Agricultural College, though rhubarb is generally remarkably free from insect pests. *Lygus invitus* (false tarnished plant bug) injured apples and pears throughout the fruit district. *Chermes similis* (spruce gall louse), which had in previous seasons injured spruce hedges about the college grounds, was found to be controllable by lime-sulphur or Black-leaf 40, alone, or combined with flour paste. The report of the brown-tail moth inspection for the season 1913–14 shows that 24,156 nests were collected, of which 22,486 were from orchard trees. It is significant that Kings County, where 86 per cent. of the total acreage is sprayed, has never been seriously infested, though repeated infestations have occurred. With regard to the San José scale [*Aspidiotus perniciosus*], the effectiveness of the inspection at the port of entry was shown by the fact that not a single infested plant escaped notice in 1914. This pest has been brought to the verge of extermination in Nova Scotia.

Ramsay (A. A.). **Lime-Sulphur Sprays: Their Manufacture Composition, and Use.**—*Dept. Agric., New South Wales, Sydney*, Science Bull. no. 13, February 1915, pp. 3–19, 6 tables.

The composition of lime-sulphur spray is profoundly affected by the relative proportions of the ingredients and water used, and the object of the chemical researches recorded in this paper was to determine as far as possible the proportions which would give the least waste and secure a maximum of economy in production based on the amount of sulphur entering solution. The proportions by weight of lime, sulphur and water contained in 7 formulae in use in Australia and the U.S.A. are given, and when reduced to the weight of sulphur and water used for each 1 lb. of lime, the range is found to be very great, varying from 0·88 to 2·08 sulphur and from 10 to 111 water. In the experimental work, pure lime and pure sulphur were used. The following conclusions were arrived at:—The best proportions of lime and sulphur are: 1 part of lime to 2 parts of sulphur. In preparing lime-sulphur solutions by boiling together lime, sulphur, and water, the maximum sulphur which it was found possible to get into and keep in solution is about 18·3 or 18·4 grams per 100 cc., corresponding to 183·8 lb. sulphur per 100 Impl. gallons. This result is obtained by using the formula 50 lb. lime (pure), 100 lb. sulphur (pure), 50 gallons water, boiled for 1 hour. The cost of the prepared spray is about 4*d*. per gallon. Using more than 50 gallons of water is not recommended from an economic point of view, for while it is true that the increased use of water gives a slightly increased percentage of the lime and sulphur in solution, the cost of obtaining it is out of proportion to the

benefit derived. The 40–80–50 formula is very similar to the one recommended, but gives a much weaker solution—122 gallons of this being equal to 100 gallons of the formula proposed.

In preparing lime-sulphur solutions, 25 gallons of water appears to be the minimum quantity of water that can be advantageously used for 50 lb. lime and 100 lb. sulphur. If this be done, and 25 gallons more water be added, a solution is obtained which closely approximates that obtained by the 50–100–50 formula. In preparing these solutions, the fluid must be boiled briskly and yet cautiously; otherwise discrepancies in composition of resulting solutions will occur.

Urich (F. W.). **Locusts or Grasshoppers.**—*Bull. Dept. Agric., Trinidad & Tobago, Port-of-Spain*, xiv, no. 4, 1915, pp. 120–128, 1 map. [Received 18th September 1915.]

In Venezuela, the following plants were attacked by *Schistocerca paranensis* between 29th May and 1st June 1915: *Cassia occidentalis*, bananas, *Erythrina umbrosa*, coconut palms, *Acrocomia sclerocarpa* (gru-gru palm), *Oredoxa oleracea* (cabbage palm), maize, cassava, peas and sugar-cane. Cacao was not touched. On 29th and 30th May, a swarm on its way to Trinidad from Venezuela was diverted by a north wind. The island of Patos, 3 miles from the mainland, was attacked by the locusts, which injured maize and coconut palms there. The soil of the island was not suitable for oviposition. According to a report from Venezuela dated 25th June, the flying insects had disappeared and their place had been taken by swarms of young hoppers. In Trinidad nothing has been heard of the few insects which arrived at the beginning of June; they have probably been destroyed by insectivorous birds.

Guppy (P. L.). **Froghopper Control.**—*Bull. Dept. Agric., Trinidad & Tobago, Port-of-Spain*, xiv, no. 4, 1915, p, 132. [Received 18th September 1915.]

The following instructions were issued in April to owners of sugar estates:—Soon after rain commences, no matter how light the showers are, careful search should be made for the first signs of the froghopper. Sometimes adults only are seen in cane-tops; in some cases these have come from long distances, mostly from abandoned fields, drains and traces. Scattered nymphs are often hidden away in places where there is enough moisture to hatch eggs that have been aestivating in favourable spots, the adults which issue from these find their way to the cultivated fields. Before the wet season begins, traces are to be hoed and the rubbish taken to the pens. All trash should be removed to the pens, and not returned to the fields till well broken up and sodden—especially the trash of the two or three rows of cane nearest traces or grass land. On appearance of froghoppers, although only a few adults may at first be seen, it is important that these should be killed in the cane tops by squeezing the leaf-sheafs; later, when they become numerous, both this method

and trap-lights should be resorted to; for the latter, dark, rainy nights will yield the best results. Early broods of nymphs should be destroyed by hand-picking.

JONES (T. H.). **The Sugar-Cane Weevil Root-Borer** (*Diaprepes spengleri*, **L.**,)—*Govt. Porto Rico, Bd. Commissioners Agric., Rio Piedras*, Bull. no. 14, 20th April 1915, 19 pp., 11 figs. [Received 30th August 1915.]

Diaprepes abbreviatus spengleri, L. (sugar-cane weevil root-borer), is apparently distributed throughout Porto Rico, but the larvae seem to cause the most serious injury to sugar-cane in the lands on the south coast between Guanica and Aguirre. Other records of the insect have been made from Barbados. The larvae injure sugar-cane by pruning off the small roots and by tunnelling into the root-stalks. This causes a stunting of the growth and, in severe infestation, the death of the plant. Serious injury is usually confined to small areas. The larvae have also been known to attack the roots of orange trees, while the adults feed on the leaves of a number of plants, including sugar-cane, various citrus trees, *Eucalyptus* sp., *Phaseolus adenanthus*, Mey, and *Malachra rotundifolia*, Schrank. The eggs are laid between parts of the same leaf or of 2 leaves, the surfaces being held together by an adhesive substance. The larva enters the soil immediately after emergence from the egg. Pupation occurs in an earthen cell in the soil. Probably the adults developed from eggs laid at any one time are not ready to oviposit until a year later and there is apparently an overlapping of generations. The adults live for a considerable time, the females apparently longer than the males. A number of birds feed upon the root-borer and should therefore be encouraged to breed about the fields; lizards are probably also beneficial. The fungus, *Metarrhizium anisopliae*, Metch., has been found on weevils kept in confinement. The collection and destruction of adults and larvae is recommended as the best means of control. While the adults probably occur on their food-plants throughout the year, there are certain times when they are much more abundant. Such periods seem to depend on the locality. At Rio Piedras, they are most plentiful from October to December. Larvae, pupae and adults occurring in the soil may be collected at ploughing time, or in serious infestations affected canes should be removed and destroyed. The cutting and burning of grass near the cane fields is advisable. No suitable insecticide has yet been discovered.

SWEZEY (O. H.). **Notes on** *Crocidosema marcidellum* **(Walsm.) (Tortricidae)**.—*Proc. Hawaiian Entom. Soc., Honolulu*, iii. no. 2, January 1914–April 1915, pp. 61–62. [Received 18th September 1915.]

Eucosma (*Crocidosema*) *marcidella*, Walsm., was obtained from fruits of *Hibiscus arnottianus* on 15th March 1914. Numerous larvae were collected and from these adults emerged from 3rd to 16th April. The larvae of this moth undoubtedly attacks related native trees in the mountains of Hawaii. The eggs are laid on the outside of the calyx. On hatching, the larva eats through this and feeds for a short time between it and the fruit, finally entering the fruit and destroying the seeds. A description of the larva and pupa is given.

SWEZEY (O. H.). **Some Hyperparasites of White Grubs.**—*Proc. Hawaiian Entom. Soc., Honolulu*, iii, no. 2, January 1914—April 1915 July 1915, pp. 71–72. [Received 18th September 1915.]

Experiments in attempting to induce *Elis sexcincta* to parasitise the grubs of *Anomala* and *Adoretus* proved negative. From the cocoons of *E. sexcincta* received, some males and one female emerged; the latter lived for several weeks, but failed to parasitise any of the larvae supplied. Two Mutillids and one Bombyliid emerged from the cocoons of *E. sexcincta*, and it is concluded that they are hyperparasites of white grubs, presumably *Lachnosterna* sp. The Bombyliid proved to be *Anthrax fulvohirta*, Wied., and the Mutillids were identified as *Mutilla castor*, Blake, and *M. ferrugata*, F.

SWEZEY (O. H.). **A Preliminary List of the Hymenopterous Parasites of Lepidoptera in Hawaii.**—*Proc. Hawaiian Entom. Soc., Honolulu*, iii, no. 2, January 1914—April 1915, July 1915, pp. 99–109. [Received 18th September 1915.]

Hymenopterous parasites play an important part in checking Lepidoptera in Hawaii. Some species of moths, however, are abundant in the mountains, frequently causing the defoliation of the plants they attack. This may be due to the fact that the relationship between insect parasites and their hosts is usually such that there is a variable ratio in numbers between parasite and host, depending on conditions which are more favourable to one or the other.

The parasites recorded include: (1) BETHYLIDAE: *Sierola molokaiensis*, Ashm., reared from *Ereunetis flavistriata*, Wlsm. (sugar-cane bud-moth); the eggs are deposited on the larva of the host; the larvae reach maturity in a few days, feeding externally on the host; *S. flavocollaris*, Ashm., from *Aristotelia elegantior*, Wlsm., a Gelechiid occurring in the fruits of *Gouldia coriacea*; *Parasierola* sp., from *Gelechia gossypiella*, Sndrs.; *Cephalonomia* sp., from *Ephestia elutella*, Hb. (2) CHALCIDIDAE: *Chalcis obscurata*, Walk., introduced from Japan to attack the Pyralids, *Nacoleia blackburni*, Butl. (palm leaf-roller) and *N. accepta*, Butl. (sugar-cane leaf-roller); it also attacks *Phytometra* (*Plusia*) *chalcites*, Esp., *Amorbia emigratella*, Busck, *Gelechia gossypiella*, etc.; *Chalcis polynesialis*, Cam., reared from the pupa of *Homoeosoma humeralis*, Butl., and probably parasitic on other Phycitids, such as flour moths; *Hockeria* sp., reared from pupae of *Ephestia elutella* and *Corcyra cephalonica*, Stn., (cereal moths), *Pyralis mauritialis*, Boisd., and *Gelechia gossypiella* (pink cotton boll worm). (3) ENCYRTIDAE: *Eupelmus dysombrias*, Perk., from *Phlyctaenia ommatias*, Meyr., and *Eupelmus* spp. from *Aristotelia elegantior*, *A. mendax*, Wlsm., *Semnoprepia* sp., etc. (4) EULOPHIDAE: *Omphale metallicus*, Ashm., from *Aristotelia* sp. n., *Gracilaria* spp., *Bedellia orchilella*, Wlsm., etc.; *Melittobia hawaiiensis*, Perk., from *Ereunetis flavistriata*, Wlsm. (5) TRICHOGRAMMATIDAE: *Trichogramma flavum*, Perk., from the eggs of *Vanessa tammeamea*, Esch., *Nacoleia accepta*, *Tortrix* (*Archips*) *postvittanus*, Walk., etc.; this is a very beneficial parasite, the life-cycle is very short, a minimum of 10 days having been obtained; *T. semifumatum*, Perk., from the eggs of

Protoparce (*Herse*) *cingulata*. (6) Ichneumonidae: *Ichneumon koebelei*, Sw., parasitising *Cirphis unipuncta*, Haw. (army-worm), *Agrotis ypsilon*, Rott., (black cutworm) and related larvae; the rate of reproduction of this form is slow; *Echthromorpha fuscator*, F., reared from *Vanessa tammeamea*, Esch., *Lycaena boetica*, L., *Phytometra chalcites*, Esp., etc.; *Pimpla hawaiiensis*, Cam., parasitising the same species as the *Echthromorpha*; *Henicospilus* spp., from *Agrotis* sp., *Scotorytha* sp. and Pyralids; *Cremastus hymeniae*, Vier., from *Hymenia recurvalis*, F., *Phlyctaenia* spp., *Bactra straminea*, etc.; *Limnerium polynesiale*, Cam., from *Plutella maculipennis*, Curt. (diamond-back cabbage-moth); *Limnerium blackburni*, Cam., from *Nacoleia asaphombra*, Meyr., *Tortrix* (*Archips*) *capucina*, Wlsm., *Tortrix* spp., etc. (7) Braconidae: *Chelonus blackburni*, Cam., from *Hymenia recurvalis*, F., *Gelechia gossypiella*, *Phlyctaemia despecta*, etc.; the larva lives singly in the host larva, emerging after the latter has made its cocoon; *Apanteles* sp., reared only from *Opogona aurisquamosa*, Butl., but probably attacking other Microlepidoptera whose larvae feed in decaying vegetation on the ground; *Bracon omniodivorum*, Terry, introduced to parasitise the palm and sugar-cane leaf-rollers; 75 per cent. of the larvae of the *Nacoleia accepta* have been found to be parasitised by this Braconid; the eggs are laid on the outside of the larva, hatch in one or two days, and the larvae reach maturity in from 3–4 days; the complete life-cycle occupies about 14 days; *Habrobracon hebetor*, Say, reared in large numbers from *Plodia interpunctella* and *Ephestia elutella*; the short life-cycle of about two weeks allows for such frequent generations that this species is very effective in controlling flour moths.

Illingworth (J. F.). **Bees Destructive to Hardwood.**—*Proc. Hawaii Entom. Soc., Honolulu*, iii, no. 2, January 1914—April 1915; July 1915, p. 140. [Received 18th September 1915.]

Xylocopa aeneipennis, De Geer, and *Lithurgus albofimbriatus*, Sich., were found boring in blocks of *Acacia koa*, Gray, which had been stored for some time. The chief damage was to the sap-wood, though in several places the burrows extended to the heart-wood. The larger tunnels were from 3 to 6 inches long and young of all stages were found inside chambers connected with them.

Barber (M. A.) & Jones (C. R.). **A Test of *Coccobacillus acridiorum*, d'Hérelle, on Locusts in the Philippines.**—*Philippine Jl. Sci., Manila*, x, Sec. B., no. 2, March 1915, pp. 163–176, 2 tables.

In view of the reported successful use of *Coccobacillus acridiorum*, d'Herelle, in the destruction of locusts in Argentina, this method was tested in the Philippines. The culture was received in May 1913 and its virulence was increased by the inoculation of a series of locusts, subsequent lots being inoculated with material taken from dead or dying locusts of the preceding series. In the first series, carried to the 30th set of insects, faeces were expressed from the abdomen and diluted with broth as the directions recommended. It was soon found that the insects did not show the required symptom, i.e., liquid excrement. In the second series, bacilli were taken entirely from the body-cavity;

in the third, the inoculation material consisted of fluid pressed with aseptic precautions from the leg of a dead or dying insect. As controls, material was taken from the body contents of 10 healthy locusts obtained from the field and was spread on agar in test-tubes. Nine tests showed no growth, while one exhibited three colonies, possibly contaminants. The controls remained in good condition for days with but little diminished numbers. In addition, controls were made of insects inoculated with *Bacillus prodigiosus*. The death of the insects followed with about the same regularity and after as short an interval as when the *Coccobacillus* was used. Another control series was started with inoculations of the gut contents of an insect which died at a station some distance from the laboratory. Insects died as quickly after intra-abdominal doses of this material as after doses of *Coccobacillus*. Field experiments were alike negative with both strains. Inoculation with the accelerated strain caused death somewhat sooner than that with the stock culture The insects in the field were mostly wingless and varied from nymphs just emerged from the egg to those in the 5th instar. The infective material was sprayed early in the day on grass or other food among and in front of the advancing swarm. The experiments extended over a period of more than 20 days and through one wet period, although for the most part the weather was hot and dry. Later experiments in which the cultures were mixed with rice polishings and syrup gave similar results. One experiment conducted in an open rice field during a relatively wet period gave partially positive results. The spray used was broth in which were crushed a number of insects found dead in a corral experiment. In no case was there any indication of a natural spread of the infection in the swarm, and cultures from dead insects found in the field and emulsions of body contents of these insects failed to give positive results in subsequent spraying. The species concerned, viz., *Œdaleus nigrofasciatus*, De Geer, and *Locusta migratoroides*, R. and F., as well as the prevailing high temperature, may have caused these negative results. According to d'Herelle, the lack of success could be attributed to a lack of strength of the virus. In the case of *Dociostaurus* (*Stauronotus*) *maroccanus*, 56 passages were required before a sufficiently strong strain was obtained. Judging from the time necessary for the bacterium to kill the inoculated insect, the virulence was quite sufficient. Experiments were continued on a new culture of *C. acridiorum* obtained from Argentina. The culture was submitted to 23 passages. In no case was there the least evidence of the spread of infection in the field.

VICKERY (R. A.). **Notes on Three Species of *Heliophila*, which injure Cereal and Forage Crops at Brownsville, Texas.**—*Jl. Econ. Entom.*, *Concord*, viii, no. 4, August 1915, pp. 389–392.

The larvae of *Cirphis* (*Heliophila*) *latiuscula*, H. S. (*subpunctata*, Haw.), *C. unipuncta*, Haw., and *C. multilinea*, Walk., have been found injuring cereal and forage crops in southern Texas. The first species has been found on maize, sorghum, sugar-cane, barley, oats and Bermuda grass, the second on the same plants and also lucerne, the third on sorghum and sugar-cane. These species are found in large numbers from November until March and are rare or absent in summer.

The method of feeding compels the larvae to expose themselves. This is probably the reason why they only feed at night and they are then subject only to nocturnal parasites. The eggs are usually laid between 2 dry, dead leaves, being cemented to them. The winter is spent in all stages, but as all are unprotected against extremes of temperature, it would seem that they cannot winter very far north. Northward migration of the adults occasioned by rapid increase in numbers at any period and consequent lack of food occurs in the case of *C. unipuncta*. Outbreaks of this species in the north are abnormal, since the larvae are killed by cold weather and therefore do not appear the following year. *C. latiuscula* will perhaps be limited to the far south owing to its preference for sorghum and sugar-cane. The larvae are controlled by the following parasites:—ICHNEUMONIDAE: *Meteorus laphygmae*, Vier., and *Henicospilos purgatus*, Say; BRACONIDAE: *Apanteles harnedi*, Vier., *A. militaris*, Walsh, *A. rufocoxalis*, Walsh, and *Rhogas atricornis*, Cress.; the Chalcid, *Euplectius platyhypenae*, How., and the Tachinid, *Peleteiria robusta*, Wied. The Tachinids, *Archytas analis*, F., and *A. piliventris*, How., have been reared from the pupae. Of these, *M. laphygmae*, *A. harnedi*, *E. platyhypenae* and *A. piliventris* have been also reared at Brownsville from *Laphygma frugiperda*. Twelve secondary parasites have been reared from the primary parasites and 9 of these have been met with in connection with *L. frugiperda*. The following parasites have been reared from *Meteorus laphygmae*: the Proctutropid, *Myrmicomorpha perniciosa*, Vier., and the Chalcids, *Spilochalcis pallens*, Cress., *S. delira*, Cress., *Dibrachys meteori*, Gahan, *Eupelmus meteori*, Gahan, and *Elasmus harnedi*, Gahan. Parasites have also been obtained from *Apanteles militaris* and *Euplectrus*. The primary parasites are controlled to some extent by the secondary; but the most important factors in their control, as in that of species of *Cirphis*, are changes in temperature and humidity.

ESSIG (E. O.). **The Dried-Fruit Beetle,** *Carpophilus hemipterus*, **L.**—*Jl. Econ. Entom., Concord*, viii, no. 4, August 1915, pp. 396-400, 4 figs.

Carpophilus hemipterus, is common throughout California, though the complete life-history there is as yet unknown. The eggs are laid on the outside of the fruit or inside, if the female can gain an entrance. The largest numbers are deposited in spring and hatch in about a week. The eggs are often laid while the fruit is on the tree or while it is drying. The length of the larval stage varies according to weather conditions; the shortest period recorded is about 4 weeks, the longest 4 months. The pupal stage lasts about 2 weeks. Breeding continues throughout the winter in warm storehouses. Larvae and adults feed directly on the fresh and dried fruit. The loss due to the amount of fruit consumed is small in comparison with that due to the presence of excreta and cast skins. Other food substances besides fruit are probably attacked. In the control of the insect it is important to adopt measures which will ensure clean packing. An insect proof container should be used. The process of dipping the fruit in boiling water or heating to 180° F. before packing is sufficient to kill all stages. Sulphur will kill the insect and the

fruit may be kept clean by storing in an insect-proof room immediately after removal from the drying house. In such cases, the fruit must be dried by artificial heat and not in the open, where infestation may readily occur. Infested storehouses, etc., should be fumigated with hydrocyanic acid, allowing 3 oz. sodium cyanide to every 100 cubic feet, or, if fitted with steam-heating apparatus, the insects may be destroyed by maintaining a temperature of 125° F. for several hours.

HINDS (W. E.). **Fumigation Method for sacked Cotton Seed.**—*Jl. Econ. Entom., Concord*, viii, no. 4, August 1915, pp. 400–402, 1 plate.

The methods of fumigation with carbon bisulphide against the cotton-boll weevil [*Anthonomus grandis*] described in this paper were worked out in Alabama and are extensively used in the treatment of cotton seed grown for planting purposes. With this method it has been found possible to treat 600 or more sacks per day with 4 men at work. The apparatus consists of a 3″ air pump with which the liquid and vapour can be forced through the seed. This is connected by pressure tubing with one branch of an ordinary ¼″ *Y* such as is used in spraying work. On this branch is a cut-off and a regular spraying accessory. On the other, is a cut-off and an indicator to measure the amount required for each sack. The *Y* is connected with tubing to penetrate the seed. The tubing is perforated for the last 18 inches to form a spray. About one ounce of carbon bisulphide is needed for a 3-bushel sack.

MERRILL (J. H.). **Notes on an apparent Relation between Aphids and Fire Blight** (*Bacillus amylovorus*).—*Jl. Econ. Entom., Concord*, viii, no. 4, August 1915, pp. 402–403.

During the spring of 1913, Aphids were found to be especially abundant in nearly every orchard in Doniphan county, Kansas, the incompletely open buds of Jonathan trees being severely attacked. Very few Aphids were found in orchards which had received a thorough dormant spraying with lime-sulphur. Fire blight appeared later in the season in all orchards where the Aphids had not been controlled, and was heaviest on Jonathan trees. In 1914 there was but a slight infestation of Aphids and very little blight appeared. In 1915 the infestation of Aphids was as severe as in 1913, and although fire blight was exceptionally abundant, only those orchards suffered in which the Aphids had not been controlled. Jonathan trees which had been treated with a contact insecticide showed little blight injury. The facts above recorded seem to show that there is a direct relation between the severity of the infestation of Aphids and blight infection. Experiments in this connection are in progress.

CROSBY (C. R.) & HADLEY (C. H.). **The Rhododendron Lace-Bug, *Leptobyrsa explanata*, Heidemann.**—*Jl. Econ. Entom., Concord*, viii, no. 4, August 1915, 2 plates.

Leptobyrsa explanata is more or less widely distributed from North Carolina to Massachusetts and as far west as Ohio. It has been recorded as abundant on *Kalmia latifolia* and *Rhododendron maximum*. The chief injury is caused by the nymphs and adults feeding on the

under surface of the leaf; they suck the sap, causing the leaf to wither. The eggs are laid in the newer leaves and the winter is passed in this stage. At Ithaca, the eggs hatch in late May or early June; in 1908, first, second and third stage nymphs were observed on 2nd June. The nymphs feed in groups; in the insectary, the nymphal stage lasted from 25 to 34 days, and is probably a little longer under outdoor conditions. These insects can be readily controlled by a soap and water spray, at the rate of 1 lb. soap to 10 U.S. gals. water. The spray should be directed against the under side of the leaves and applied as soon as the nymphs are observed. More than one application during the season may be necessary. In the case of rhododendrons, the spray should not be applied while the sun is shining or the leaves will be scorched.

Davidson (W. M.). **Little-known Western Plant-Lice. I.**—*Jl. Econ. Entom., Concord*, viii, no. 4, August 1915, pp. 419–429, 3 plates.

Phylloxera salicola, Pergande, occurs in California on *Salix lasiolepis*, Benth. Infestations are mostly confined to the axils of the buds on the twigs, but in one instance a heavy infestation occurred on the bared roots of a willow growing on the bank of a stream. The roots were about ½ inch in diameter and the aphids occurred in all the small cracks in the bark. No nymphs or winged forms were found. According to Pergande, some of the eggs deposited by apterous females are sexual. In California no sexual forms have been found and probably the asexual generation reproduces throughout the winter. Colonies comprising eggs and lice in all stages were collected on 6th November 1913, 3rd February 1914, and 15th October 1914. *P. popularia*, Pergande, infests the limbs and twigs of *Populus trichocarpa* and *P. fremontii*, Wats. The individuals are covered with a white cotton-like substance and are found in cracks in the bark. They also invade old galls of *Thecabius populicaulis*, Fitch. Specimens were collected on 20th April and 4th May 1914, in California. In the latitude of San Francisco, the sexuparae of *Thecabius populicaulis* have been observed under poplar bark in late winter and spring. The single egg is laid in a crevice of the bark and covered by cottony filaments excreted by the female. Incubation in May takes about two weeks. The fundatrix ascends the tree and settles at the base of a leaf. The petiole swells at the point of attack and a gall gradually forms around the growing Aphid. A Syrphid fly, *Pipiza pisticoides*, Will., has been bred from a larva found feeding on the sexual forms of this Aphid. The winged spring migrants in the latitude of San Francisco are found in the galls from May to November. The sexuparae of *Prociphilus fraxini-dipetalae*, Essig, were taken under the bark of *Fraxinus oregana* on 16th March 1915. Nearly all the winter eggs had hatched on this date. The young stem-mothers occurred higher up on the tree either in cracks in the bark or on the expanded foliage. The spring migrants of *P. fraxini-dipetalae* have been taken on ash and olive and occur all over California. *Euceraphis gillettei*, sp. n., occurs in California on the underside of the leaves of *Alnus rhombifolia* and in Colorado on *Betula fontinalis* and *Alnus* sp. *Eucallipterus flavus*, Davidson, was collected in October from the leaves of *Alnus rhombifolia*. The eggs are laid in groups at the axils of the new buds on the twigs or canes.

During October 1914 sexual forms predominated and in the first half of November oviposition was in progress. *Myzocallis pasaniae*, sp. n., occurs on the under side of the leaves of *Pasania densiflora*, Oerst., (tan-bark oak). Winged, viviparous females were taken on 12th June 1914, 6th November 1914 and 17th February 1914. The winter-eggs of *Macrosiphum heucherae*, Thomas, have been found on the flower-stalks of *Heuchera hartwegii*, Dougl. ; they were being deposited on 25th May.

LEONARD (M. D.). **The immature Stages of the Black Apple Leaf-Hopper** (*Idiocerus provancheri*, **van Duzee**).—*Jl. Econ. Entom., Concord*, viii, no. 4, August 1915, pp. 415–419, 1 plate.

The nymphs of *Idiocerus provancheri*, van Duzee, (black apple-leaf hopper) have occurred during spring and early summer on the leaves of apple at Ithaca and on apple twigs at Cornell University during March and April. Nymphs have been also found on quince and pear. The winter is passed in the egg-stage. The nymphs feed chiefly on the under side of the leaves and, when disturbed, move rapidly over the leaves and stem. Hatching of the nymphs apparently begins at about the time the blossom clusters appear. At Rochester Junction, a number of nymphs in the 3rd instar were observed on 4th June 1914 ; on 10th June an adult was taken from the same tree. According to Crosby, the eggs are inserted into the bark of the fruit spurs about $\frac{1}{4}$ inch from the base of the buds. They were observed by him at Stuyvesant Falls, N.Y., on 29th April. Other records of this species are from Montreal, Winnipeg, Hamilton and Buffalo, and it is said to occur as far west as Iowa.

Scientific Notes.—*Jl. Econ. Entom., Concord*, viii, no. 4, August 1915, pp. 429–431.

Alabama argillacea, Hb., (cotton moth) was observed in Kent, Ohio, on 23rd September 1914, following several days of warm weather with a strong south wind. During April 1915 a number of reports of injury to radishes by *Ceuthorrhynchus rapae*, Gyl., (cabbage curculio) were received from Kansas. In many cases early radishes were completely destroyed. In eastern Kansas early radishes were injured by *Phyllotreta vittata*, F., (striped turnip flea-beetle) and *P. pusilla*, Horn, (western cabbage flea-beetle). The work of both species was confined chiefly to the succulent stem just at the surface of the ground, causing the leaves to wither. Where the plants were an inch or more in height, the leaves were attacked.

Pomphopoea aenea (blister beetle) was obtained from the flowers of plum in Brown County, Indiana, on 8th April 1915. Serious damage was caused by the adults, which consumed all parts of the flower. A spray consisting of 5 lb. lead arsenate and 1 pt. Black Leaf 40 in 50 U.S. gals. water was efficient in controlling the infestation.

COOK (A. J.). **The Citricola or Citrus Gray Scale.**—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, no. 8, August 1915, pp. 373–374.

The secretion of *Coccus citricola* (citrus grey scale) attracts black smut fungus which causes injury to the foliage and fruit of the plants

attacked. This scale is free from effective parasites or predaceous enemies, but can be controlled by fumigation between 15th July and 15th August, and *Saissetia oleae* (black scale) between 1st August and 1st January.

WELDON (G. P.). **Potatoes as a Trap-Crop for Wireworms.**—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, no. 8, August 1915, p. 374.

A crop of beans at Davis, California was saved from the attacks of wireworms by the use of small pieces of potato placed between the rows, while a patch of about 30 acres, which remained untreated, was entirely destroyed. Though this method is only in the experimental stage, it seems to possess great possibilities.

WELDON (G. P.). **White Fly at Marysville.**—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, no. 8, August 1915, pp. 386–388, 1 fig.

Since the discovery of *Aleurodes* (*Dialeurodes*) *citri* (whitefly) at Marysville in 1907, inspections made each season have revealed its presence, but not generally to a serious extent. Efforts at complete eradication have been unsuccessful. In order to test certain oil sprays under California conditions, an experiment was conducted at Marysville on 7th December 1914. An examination made on 19th January 1915 showed that all strengths of miscible oil and distillate emulsion had been satisfactory. Further experiments were performed on 15th February; miscible oil no. 1 was used at 6 per cent. strength, with the addition of 2 quarts of liquid whale-oil soap to 200 gals. of spray. A pressure of from 180 to 200 lb. was used. Results showed that 98½ per cent. of larvae and pupae were killed. In the preliminary work there was apparently no scorching of foliage at the maximum strength of 10 per cent. The later spraying with 6 per cent. miscible oil, performed just before the time of flowering, resulted in almost total defoliation and more or less severe injury, especially if carried out on a hot day. Spraying performed in cool, cloudy weather did little if any harm to trees, though it caused some foliage to drop. Later in the season, as the new foliage appeared, *Aphis gossypii* became very abundant and was the cause of an additional set-back to the trees. Spraying should therefore be done in winter or early spring.

CRAWFORD (D. L.). **Potato Curly Leaf.**—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, no. 8, August 1915, pp. 389–391, 2 figs.

Potato plants in the San Gabriel region are attacked by *Euthrips occidentalis*, with considerable injury to the leaves and crop. Curling of the leaves results when the expanding buds or very young leaves are attacked; older leaves only become spotted. Injury by *E. occidentalis* is invariably followed by infestation by a fungus, *Macrosporium solani*. The dwarfing of the plants is often very severe. The yield of tubers is seriously reduced, averaging one-fifth to one-third of the normal crop. In addition to potato, many garden flowers, as well as oranges and lemons, are attacked. The incubation period of the egg is less than a week. The larvae mature in a week after hatching. The adult lives for several days after

oviposition and injures the foliage of the host. In spraying to control the insect, it is suggested that Bordeaux mixture and tobacco extract be used, at the rate of 1 pint tobacco extract to 100 gals. Bordeaux mixture. The first application should be made not more than a month after planting, and the second about 3 weeks later.

VOSLER (E. J.). **Calendar of Insect Pests and Plant Diseases.**—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.* iv, no. 8, August 1915, pp. 392-399, 7 figs.

Saissetia oleae (black scale) is generally distributed in all citrus growing sections south of Tehachapi; it is most destructive in the coast counties, probably owing to the humid conditions. The eggs are usually laid from May to July, but sometimes all stages are met with throughout the year. This uneven hatching is most common near the coast and causes poor results from fumigation, since eggs and old scales are resistant to this treatment. The formula for the generation of hydrocyanic acid gas used in fumigation is as follows: 1 oz. sodium cyanide, $1\frac{1}{4}$ fluid oz. sulphuric acid (66° Bé.), and 2 fluid oz. water. The time of exposure is from 45 to 60 minutes; the optimum tempera ture is between 80° to 85° F. Orchards previously sprayed with Bordeaux mixture should not be fumigated. On deciduous fruit trees and olives, spraying is efficient and should be applied before the scales have become half grown; water distillate caustic soda mechanical mixture, distillate oil emulsion, crude oil emulsion or miscible oils may be used. The formula for the caustic soda mixture is as follows: water, 200 gals., caustic soda (95 per cent.) 7 lb., and distillate (28° Bé.), 10 gals. Distillate emulsion consists of: distillate, 20 gals.; whale-oil soap, 30 lb.; water, 12 gals.; this is diluted in 20 parts water before use. *Lepidosaphes beckii* (purple scale) and *Chrysomphalus aurantii* (red scale) occur in the southern citrus belt of California. *C. aurantii citrinus* (yellow scale) is found throughout the entire citrus-growing section and is especially abundant in the interior valleys. It also attacks rubber, ivy and citron. *Pseudococcus citri* (mealy bug) occurs in greenhouses throughout the State, and is occasionally a pest in Ventura, San Diego and Los Angeles counties. The spray found most efficient against it is carbolic acid emulsion, prepared according to the following formula: water, 40 gals.; whale-oil soap, 40 lb.; crude carbolic acid, 5 gals. This spray should be applied between October and March.

Insect Notes.—*Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.* iv, no. 8, August 1915, p. 400.

A heavy infestation of the elm-leaf cluster louse was found in Yolo County on 15th July, the winged form being common. Egg masses of *Chrysopa californica* were present; the larvae, upon hatching, burrowed into the leaf clusters in order to feed on the lice. *Diabrotica soror*, Lec. (western cucumber beetle) was abundant. The Cerambycid, *Ipochus fasciatus*, Lec., has recently been received from Ventura county. *Eulecanium (Lecanium) canadense*, Ckll. (brown elm scale) occurred on elm in Yolo county. A colony of *Chilocorus bipunctatus*,

imported from Italy, was released at Fair Oaks on *Coccus citricola* and *Saissetia oleae*. *Epitrimerus pyri* (pear-leaf rust-mite) occurs quite commonly on pear trees in the Sacramento Valley and in parts of Lake county. Control measures will probably be necessary. *Thrips tabaci*, L., (onion thrips) is abundant in beans in Sacramento Valley. *Camnula pellucida* has been troublesome in Ventura county ; a poisoned bran mash was used to control it. *Heliothrips fasciatus*, Perg., was reported on almonds in Capay county. An undetermined species of mealy bug caused considerable damage to Bartlett pears in a few orchards in the Sacramento Valley. The insect enters the calyx of the small pear and feeds there during the season. Large numbers of *Hippodamia convergens* were collected in the Feather River Cañon on 1st July. Several colonies of *Leptomastix* sp., the Sicilian mealy-bug parasite, were received for liberation. Specimens of *Trichobaris trinotata*, Say, were taken on *Datura meteloides*. This is probably the first record of the potato-stalk weevil in California, outside of the Imperial Valley. A mite, *Rhizoglyphus rhizophagus*, Banks, was injurious to onions in Los Angeles county.

MASKEW (F.). **Quarantine Division, Report for the Month of June 1915.** *Mthly. Bull. State Commiss. Hortic., Sacramento, Cal.*, iv, no. 8, August 1915, pp. 401–402.

Among the pests intercepted were :—From Belgium : *Aspidiotus hederae* on palms ; *Cerataphis lataniae*, *Aspidiotus lataniae* and *A. rapax* (*camelliae*) on Kentia palms. From China : *Cylas formicarius* in sweet potatoes. From Hawaii : *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples and *Coccus longulus* on betel leaves. From Japan : *Pseudaonidia duplex* on camellias. From Mexico : *Lepidosaphes beckii* and *L. gloveri* on limes and *Chrysomphalus aonidum* on green coconuts. From Pennsylvania : *Chrysomphalus aurantii*, *C. aonidum*, *Aspidiotus britannicus*, *A. lataniae* and *Cerataphis lataniae* on palms. From Tahiti : *Morganella maskelli* on limes and oranges and *Hemichionaspis aspidistrae* on an unknown plant. From New York : *Parlatoria pergandii* on orange trees.

WALTON (W. R.). **A New and Interesting Genus of North American Tachinidae.**—*Proc. Entom. Soc. Washington, Washington, D.C.*, xvii, no. 3, September 1915, pp. 104–107, 6 figs.

A description is given of *Coquillettina plankii*, gen. et sp. nov., reared from an undetermined species of grasshopper at Pasadena, N.J., on 8th August 1914.

ROHWER (S. A.). **A remarkable new Genus of Cephidae.**—*Proc. Entom. Soc. Washington, Washington, D.C.*, xvii, no. 3, September 1915, pp. 114–117, 5 figs.

Syntexis libocedrii, gen. et sp. nov., which was reared from larvae and pupae collected in the cells near the outer surface of the wood of *Libocedrus decurrens*, Torr. (incense cedar), is described. The specimens were collected on 8th August 1913 ; adults emerged on 22nd June 1914.

CUSHMAN (R. A.). **Descriptions of New Ichneumonidae and Taxonomic notes.**—*Proc. Entom. Soc. Washington, Washington, D.C.*, xvii, no. 3, September 1915, pp. 132–142.

The following species of economic importance are described and recorded: *Calliephialtes thurberiae*, sp. n., reared from larvae of *Anthonomus grandis thurberiae*, Pierce, obtained in bolls of *Thurberia thespesiodes*, collected on 12th April 1913; *Calliephialtes grapholithae*, Cress. (*C. xanthothorax*, Ashm.); *Homaspis nigripes*, sp. n.; *Notopygus scutellatus*, sp. n.; *Trematopygus caliroae*, Viereck; *T. eriocampoididis*, sp. n., reared from *Eriocampoides limacina*, L. (*cerasi*, L.), taken on 26th August and 5th September 1914 on cherry trees badly infested by the pear slug; *Omorgus tortricidis*, sp. n., and *O. ferrugineipes*, Ashm., both bred from *Polychrosis viteana*; *O. phthorimaeae*, sp. n., reared from *Phthorimaea operculella*; *Xenoschesis slossonae*, sp. n.; *X. gracilis*, sp. n.; *Bassus carpocapsae*, Cush., reared from *Cydia pomonella*.

CRAWFORD (J. C.). **The Genus *Secodella* in North America.**—*Proc. Entom. Soc. Washington, Washington, D.C.*, xvii, no. 3, September 1915, pp. 142–144.

The following new species of Chalcids are described: *Secodella cushmani*, sp. n., reared from *Polychrosis viteana*; *S. acrobasis*, sp. n., reared from *Mineola* (*Acrobasis*) *indiginella* var. *nebulella*; *S. rugosus*, sp. n., and *S. viridis*, sp. n.

WALTON (W. R.). **A new nocturnal Species of Tachinidae.**—*Proc. Entom. Soc. Washington, Washington, D.C.*, xvii, no. 3, September 1915, pp. 162–164, 3 figs.

Neophyto nocturnalis, sp. n., collected at Forest Glen, Md., is described. This species is probably parasitic upon nocturnal Coleoptera, possibly *Lachnosterna*.

SHAFER (G. D.). **How Contact Insecticides kill. Part 3.**—*Michigan Agric. Coll. Expt. Sta., Div. Entom., East Lansing.* Technical Bull. no. 21, July 1915, 67 pp., 3 figs., 1 plate, 7 tables. [Received 27th September 1915.]

Contact insecticides become effective in one or both of the following ways:—(1) Through conditions connected only with proximity with the external integument or with the invaginations of the body wall (tracheae and hind-gut); (2) through effects brought about after a possible absorption into the body tissues.

Alkaline washes, corrosive sublimate solution, etc., are capable of penetrating the chitin. Penetration of gases, especially through the tracheae, is more rapid than that of liquids. The gases act on the

nervous system, producing at first, excitement, then uncertain movements, then narcosis. Evidence seems to show that the vapours of gasolene, kerosene and carbon bisulphide become effective after absorption, through a tendency to prevent oxygen absorption by the tissues. These three gases, when at sufficient concentration, as well as heat of certain intensities, affect the activities of certain enzyme-like bodies in the tissues of the living insects. If the activity of these bodies is of vital significance, then the disturbance of the balance of activities must be an important, and perhaps in some cases the determining, factor in causing the death of treated insects. Fat or fat-like membranes absorb gasolene and chloroform vapour from air charged with these gases, and the absorbed vapour renders the membrane less permeable to oxygen. This may account for the fact that less oxygen is used by an insect under the influence of gasolene, since the living, oxygen-absorbing cells and the body fluids surrounding them are impregnated with the vapour. Waxen membranes, after treatment with lime-sulphur solution, have been found to become less permeable to oxygen. Pupae of the luna moth and adults of *Passalus cornutus* in a dormant condition arising from cold, were found to absorb less gasolene or ether vapour in air than did the same insects when most active, at a warm temperature, in air charged with the same percentage of gas. This lowered absorption capacity may furnish the chief explanation of the fact that insects dormant from cold are more difficult to kill by ordinary fumigants and by those contact sprays which depend partly on volatile insecticide ingredients for their effectiveness. Certain non-volatile powders may act as insecticides in some cases. They stick fast in exudations on parts of the body, where they become partly dissolved and absorbed through the integument. Powdered borax and sodium fluoride may act in this way, but normally they become stomach poisons, since insects such as cockroaches swallow some of the powder in cleaning it from their bodies. A very fine, dry powder passes readily into all crevices and adheres well; similarly a weak surface tension enables a liquid insecticide to flow into all irregularities. Extracts taken from the leaves and stems of *Saponaria officinalis* were found to increase the spreading power of lime-sulphur solution, and this fact may prove useful in orchard spraying. Experiments with ammonia, derived from dry, liquefied ammonia, as a fumigant for mill insects were not very successful; but the liquefied ammonia was easy to apply and might prove to be a desirable fumigant in some instances. When carbon tetrachloride was compared with carbon bisulphide as to its action on grain insects in air-tight flasks, six times as much of the former was required for effective fumigation. The carbon tetrachloride was vaporised by heat and used at the rate of 3·55 lb. per 100 cubic feet to control moths in fur; fumigation was repeated every five weeks during the summer. This strength killed adults of *Tinea bisellicla*. Evidence indicates that heat might be applied with advantage as an insecticide in many cases in which it has not yet been used. It was found that the San José scale [*Aspidiotus perniciosus*] on thickly infested twigs could be killed by submerging for five minutes in water heated to 130° F. Green apple aphis [*Aphis pomi*] was killed in half a minute by water at the same temperature. Most household insects succumb readily to heat. Adults of *Tinea bisellicla* are quickly killed at 119° F.

CONRADI (A. F.) & EAGERTON (H. C.). **The Cotton and Corn Wireworm.** —*South Carolina Agric. Expt. Sta., Clemson College*, Bull. no. 180., December 1914, 16 pp., 4 plates. [Received 21st September 1915.]

The greatest loss occasioned by *Horistonotus uhleri*, Horn, (brown click beetle) is in Colleton county, where the area of heavy infestation covers about 16 square miles. Other records of injury have been made from Beaufort county, Dorchester county and other portions of S. Carolina. It is not improbable that infested territory includes the sandy uplands of the lower and upper pine belts, together with the coastal lands. Apparently the larva cannot live in soil through which the water does not percolate rapidly, and in which there is an insufficient air supply. The chief damage done by the larva is in light, upland, sandy soils, barren of humus, in which extensive root-surface is required by the plants. Clay, and sandy soils filled with seepage water from higher points are not infested. Compact and water-logged soils prevent egg-laying. The season of oviposition lasts from 1st June to 15th September, the main period being from 15th June to 10th August. The average incubation period is 13 days, at a temperature of 20° to 30° C. The larvae live almost entirely about 4 inches below the surface, only going deeper during cold weather and dry periods. Under normal conditions movements are confined to a small area. Food-plants include cotton, oats, rye, tobacco and maize. The larvae feed on the young roots of the host, thereby causing a stunted growth. Pupation takes place in one of the tunnels, from 4 to 6 inches below the surface, and from 4 to 12 inches from the roots of the host. The earliest pupae were found on 13th May. The pupal period lasts 10 or 12 days. The male emerges from the soil and feeds for a short time on the juices of maize, grass, etc. ; the female remains in the soil until ready to pair, and after pairing burrows into the soil to oviposit. The larvae and adults are subject to attack by certain predaceous enemies, such as the larva of the Elaterid, *Monocrepidius vespertinus*, the Therevid fly, *Psilocephala* sp., the Asilid, *Proctacanthus brevipennis*, Wied., and a mite, *Rhizoglyphus phylloxerae*, Riley. The cannibalistic habits of the larvae in the young stage are very marked. Leaving land uncultivated has been the only artificial method of control employed up to the present. While crop rotation has no direct influence on the intensity of infestation, it is one of the most important of control measures, in that the fertility of the soil is thereby increased. Disturbance of the surface at the time of egg-laying should be avoided. Oats should come into rotation as often as possible, since the stubble can be left on the land until 15th September. Deep ploughing from 15th May to 15th June is especially effective, but can rarely be practised owing to the crops growing at that time. The planting of cover crops after 15th September is an important control measure. These crops should be supplemented as far as possible with stable manure. Lime is apparently of value in wireworm control and has the further effect of making the soil firmer.

XAMBEAU (Capitaine). **Moeurs et métamorphoses des insects.** [Habits and metamorphoses of insects.]—*L'Echange, Rev. Linn., Moulins*, xxxi, nos. 368 and 369, August and September 1915, pp. 33–40.

Among the species recorded the following are of economic

importance: *Tenebrio molitor*, L., feeding in the larval stage on bran and flour; *Pytho depressus*, L., predaceous on the larvae of other insects; *Balaninus nucum*, L., occurring in the larval stage in the hazel-nut; *Anthonomus pedicularius*, L. (*ulmi*, de Geer), living in the buds of the elm; *Cionus fraxini*, de Geer, from the leaves of ash; *Orchestes rufus*, Schrank, the larva of which mines in the leaves of elm; *O. alni*, L., mining in the leaves of alder; *Calandra granaria*, L., in the grain of all kinds of cereals; and *Bruchus pisorum* L., (*pisi*, L.), destructive to peas and other leguminous crops.

Lesne (P.). **Mediterranean Fruit-Fly** (*Ceratitis capitata*) **injuring Pears near Paris.**—*C. R. des Séances de l'Académie d'Agriculture de France*, i. no. 16 (July 28th 1915), pp. 495–497. (Abstract from *Mthly. Bull. Agric. Intelligence & Plant Diseases*, Rome.)

In October 1914 some late pears gathered at Asnières, Seine, were found to be bored by galleries quite different from those made by codling moth larvae (*Cydia pomonella*). Each pear contained a single gallery, which was of irregular outline and full of brown gnawed pulp; there were as many as ten Muscid larvae at the end of each. In the laboratory some of the larvae pupated, but only two emerged, on 12th December, when they were recognised as examples of the Mediterranean fruit-fly (*Ceratitis capitata*, Wied.). The land on which the pears were grown is near Courbevoie, where Giard first recorded *C. capitata* in the Paris district in 1900; at that time the damage was done to apricots, the crop being largely destroyed on some farms. In 1906 Giard noted that this pest was still doing damage, peaches being seriously injured in various places round Paris. It would be of value to know how it passes the winter in France; probably it does so in the pupal state. Its apparently permanent presence is a new menace to fruit-growing in this district.

Sanzin (R.). **Citrus White-Fly** (*Aleurodes citri*) **on Lemons and Oranges in the Province of Mendoza, Argentina.**—*La Enologia Argentina, Mendoza*, i, no. 2, 1st June, 1915, pp. 42–43, 6 figs. (Abstract from *Mthly. Bull. Agric. Intelligence & Plant Diseases*. Rome.)

The citrus white-fly (*Aleurodes citri*) has spread so rapidly in the province of Mendoza that it is now one of the worst pests of oranges and lemons; not a single tree seems to be free from its attacks, which cause withering of the leaves. The best means of destroying the insect is to spray in spring before flowering with lime-sulphur or petroleum emulsion. Both these washes destroy the white waxy covering of the insect and so can act directly on it. The following are the formulae recommended:—Lime-sulphur mixture: sulphur 2·8 lb.; slaked lime 2·8 lb.; common salt 2·8 lb.; water 8·5 gals. To about a gallon of boiling water add first the sulphur, then the lime and lastly the salt; after boiling for an hour or an hour and a half with constant stirring, allow to cool, syphon off and make up to 8½ gallons. Petroleum emulsion: Petroleum 1/10 gal., soft soap 3 lb., water 10 gallons.

Dissolve the soap in boiling water and add the petroleum, stirring constantly till an even emulsion is obtained.

BONDAR (G.). **Enemies of the Coconut Palm on the Coast of Brazil.**—*Secretaria da Agricultura, Commercio e Obras Publicas de Estado de São Paulo, Boletim da Agricultura, São Paulo*, Series 16, no. 5, May 1915, pp. 435–441, 6 figs. (Abstract from *Mthly. Bull. Agric. Intelligence & Plant Diseases*, Rome.)

The coconut palms are frequently attacked by a bacterial disease which has destroyed trees at Santos; injuries caused by insects are regarded as promoting the spread of the disease. The Curculionid, *Amerrhinus pantherinus*, Oliv., lays its eggs in the petioles of the leaves in which the larvae burrow longitudinally to such an extent that they turn yellow and die. Other Curculionids injurious to native Brazilian palms are: *Homalonotus coriaceus*, Gyl., *H. deplanatus*, Sahlb., *Sphenophorus ensirostris*, Germ., *Rhynchophorus palmarum*, L., and *Archarias parcus*, Fhs.; these insects may easily become pests of coconuts. *Alurnus marginatus*, Guér., a Chrysomelid found on the coast of Brazil, has attacked coconuts near Santos. The larvae devour the young leaves as they begin to unroll, and also find their way into the buds, thus destroying the future leaves; serious injury is also done to the well-developed leaves. In Brazil *Cocos romanzoffiana* is attacked by the larvae of *A. 4-maculatus*, Guér., and of *A. corallinus*, Vig.; the latter pest has also been observed at Bahia. For the control of these Chrysomelids, spraying with poisonous substances has been used to advantage. The spray must be directed against the green parts of the trees and especially against the buds.

TULLGREN (A.). **Jordgubbarnes och smultronens fiender bland de lägre djuren.** [The insect enemies of strawberries.]—*Trädgården, Stockholm*, xiv, no. 6, June 1915, pp. 167–169, 2 figs. [Received 12th September 1915.]

The roots of strawberries are attacked by the larvae of cockchafers wireworms and cutworms, and the larva of *Hydroecia micacea*, especially, has repeatedly been recorded as doing damage to the stems. The Nematode, *Apheleneus fragariae*, Ritz. Bos, has also once been recorded from Sweden, in Upland, when about 2,000 plants had to be destroyed. No effective remedies are known against these pests except digging up and destroying the plants attacked by *Aphelenchus*. The leaves are attacked by a mite, *Tarsonemus fragariae*, Zimm., which lives on their under surface, causing the leaves to turn brown and shrivel. The leaves are also attacked by several beetles and larvae of Lepidoptera and Hymenoptera, such as both larva and imago of *Galerucella tenella*, L., the larva of *Batophila rubi*, Payk., and the sawfly, *Blennocampa geniculata*, Steph., which oviposits on the edges of the leaves. Against these insects spraying with arsenicals is recommended. The flowers are injured by *Anthonomus rubi*, Hbst., the female ovipositing in the young buds and making an incision in the stalk which prevents the buds from opening. These weevils are easily collected in nets.

Da Costa Lima (A.). **Sobre alguns Curculionideos que vivem nos bambús. II.** [On Some Curculionidae living in Bamboo stems. II.]—*Mem. Inst. Oswaldo Cruz, Rio de Janeiro*, vi, no 3, 1914, pp. 224–230, 2 plates. [Received 10th August 1915.]

This paper deals with additional weevils infesting bamboos [see this *Review*, Ser. A, iii, p. 306]. A species of bamboo found at Manguinhos is attacked by *Astyage lineigera*, Pasc.; the female oviposits in the same way as *Erethistes lateralis*, Boh., but does not bore a circle of contiguous holes in the wall. Usually only one egg is laid in each internode, but several in one stem. The larva feeds on the inner layer of the joint, making deep excavations or longitudinal furrows; the larval stage probably lasts several weeks, and at its close, a cocoon of bamboo fibres is constructed at the upper end of the cavity. The imago rests for two days after emergence and then seeks the deepest furrow and bores its way out. The larvae appear to suffer from a disease resembling flacherie. Specimens of damaged bamboo have been received from other localities, which lead the author to suspect the existence of another species of bamboo-borer. Dr. Lutz has reared specimens of *Perideraeus granellus*, Boh., *Erethistes lateralis*, var. *catharinensis* var. nov., and *Dionychus parallelogramus*, Germ., from bamboo stems in the province of Santa Catharina.

Schoyen (T. H.). **Indberetning om skadeinsekter og snyltesopp paa skogstraeerne i 1913.** [Report on the noxious insects and parasitic fungi of forest trees in Norway in 1913.]—*Indberetning om det Norske skogvaesen* 1913, *Kristiania*, 1914, pp. 140–149, 2 plates. [Received 14th September 1915.]

Webs and egg-clusters of *Orgyia antiqua* on pine trees were sent from Olen in Sondhordland, where they were reported to be fairly common. *Rhyacionia* (*Retinia*) *resinella* occurred as in the previous years in the plantations on Jaederen; this moth sometimes does considerable damage by destroying the leading shoots of the young trees. At Namdalen in October. fir-needles were mined by *Eucosma* (*Grapholitha*) *tedella*, and in April it was reported that *Eucosma* (*Grapholitha*) *nanana* had injured the forest at Lierna, this being the first time that damage caused by this moth has been recorded from Norway. Attacks of *Myelophilus piniperda*, one of the most dangerous insects in Norway, occurred near Myklebustad; the damage was chiefly done to 30 to 50-year-old trees. *Lophyrus rufus* was more or less common in all plantations from 5 to 20 years old in the western part of the country. At Fitjaar, the larvae were killed in great numbers by some disease. *Lygaeonematus* (*Nematus*) *erichsoni* was recorded from Ryfylke. *Chermes pini* is of no importance in Ostlandet, but in Vestlandet it seems to be getting the upper hand in the plantations, and 5 to 20-year-old trees, growing on dry and poor soil, very often succumb to attack. Spraying the infested trees with nicotine fluid (6 lb. fluid, 14 lb. soap and 28 gallons of water) is recommended. *Chermes piceae* at Tveitali injured some silver firs. *Tetranychus telarius* [probably *Paratetranychus ununguis*] injured fir trees. The larva of *Cossus cossus* damaged some birch trees and mountain ash. In the southern part of the country ravages

by *Hyponomeuta padellus* and *H. euonymellus* occurred. The attacks of *Galerucella* (*Galeruca*) *lineola* on the alder forests in Vestlandet, which began in 1912, continued in 1913 with, if possible, still greater severity; frequently the trees were killed, which was a serious loss, as in many places this is the only kind of tree which grows on the slopes of the fjords and their leaves are largely used as forage. *Melasoma* (*Lina*) *aeneum* occurred together with *G. luteola* and, at Telemarken, it seemed to outnumber it. *Cladius viminalis* was reported from Ingdalem, where the larvae in two years defoliated some big balsam poplars. The following Aphids were recorded:—*Tetraneura ulmi* on elm, *Lachnus fagi* on beech trees, *Phylloxera quercus* on oak, *Aphis avenae* on bird cherry, *Phyllopsis fraxini* on ash and *Psylla alni* on alder. *Hylotrupes bajulus* for many years has done great damage to timber in houses, and another Cerambycid *Callidium violaceum* appeared in great numbers in several houses, having in all instances been brought in with the timber. *Anobium striatum* occurred in furniture, both new and old, and *A. pertinax* was recorded in the timber of an old house; *Formica herculeana* also damaged timber in a house.

Trägårdh (I.). **Granknoppsmalem** (*Argyresthia illuminatella*, **Zell.**) **en i vart land hittills obeaktad skadegörare.** [The fir bud moth, *Argyresthia illuminatella*, Zell., a hitherto unnoticed pest in Sweden.]—*Skogen*, ii, no. 7, July 1915, pp. 188–191, 2 figs. [Received 14th September 1915.]

Argyresthia illuminatella has hitherto only been recorded from Germany, where it sometimes injures the fir plantations, and is evidently common in Sweden, although it is now recorded as a pest in that country for the first time. The larva attacks the young buds and hibernates in them; pupation takes place in May of the following year and the moths appear in the latter half of June; only one generation occurs in the year. When the terminal buds of young trees are attacked, their development is arrested, but the lateral buds usually develop normally. A very characteristic feature of the damage is the narrow, spirally twisted gallery in the axis of the bud, which the larva excavates previous to entering the terminal bud. When, on the other hand, the small buds on the lower branches of older trees are attacked, not only the terminal and lateral buds are completely excavated, but also part of the axis. At the end of the excavated part of the axis is a circular hole made by the larva when it has finished feeding and before it returns to the bud in order to pupate. *A. illuminatella* has already been recorded from several localities in Sweden. It occurs commonly in the neighbourhood of Stockholm and has been reported from Västernorrland and from Strömsund in Jämtland, where from 25 to 50 per cent. of the young trees were attacked.

Lind (J.), Rostrup (S.) & Kolpin Ravn (F.). **Oversegt over Landbrugsplanternes sygdomme i 1914.** [Review of the diseases of agricultural plants in 1914.] 91. *Beretning fra Statens Forsogsvirksomhed i Plantekultur*, no. 31, *Kobenhavn*, 1915. [Received 14th September 1915.]

Amongst insects injurious to cereals in Denmark, the larva of *Tipula paludosa* did serious damage to oats and barley, chiefly in May and June

and on soil rich in humus. *Phyllopertha horticola* swarmed as usual in June in several places and attacked various trees. The larva of *Dascillus cervinus* attacked oats and *Heterodera schachtii* var. *avenae* during the dry summer caused great damage, especially to oats or crops mixed with oats, when the intervals in the rotation were too short. The use of nitrogenous fertilisers has often been observed to check these attacks. *Hylemyia coarctata*, especially in Fyn, caused some damage, but not so much as in 1913. In Fyn a comparatively serious attack of *Phyllotreta* (*Haltica*) *vittula* on winter barley was observed in May, this being the first time that this pest has been recorded from Denmark. *Oscinella* (*Oscinis*) *frit* has been exceedingly common and the attack has been quite as serious as in 1905. The climatic conditions have also been the same in these two years, viz: a mild winter, a warm March, cold weather in April and May, involving late sowing, followed by drought and hot weather. The attack began in May and continued throughout the summer. Attacks of *Chlorops taeniopus* were observed during June and July. *Trachea* (*Hadena*) *secalis* was comparatively scarce, but occurred as usual in May in the oatfields. *Contarinia tritici* was scarce, but *C. aurantiaca* was present in the usual numbers. *Limothrips denticornis* was common in the rye fields in May and June, but, with a few exceptions, no serious damage was noticed. *Anthothrips aculeatus* has been observed in some localities in rye, and thrips were common as usual in oatfields. At Aarhus, *Eurydema* (*Strachia*) *oleraceum* did some damage to barley and oats in June and July. *Aphis avenae* and *Siphonophora cerealis* caused great injury in some places at the end of July and the beginning of August. At Askov, an attack, probably of *S. cerealis*, was noticed in August. At Aarslev and Tune, some damage was caused by *Tarsonemus spirifex*.

Pests of leguminous plants included *Sitones lineatus* on peas at the end of March and in April. In July, in some localities peas were attacked by *Siphonophora pisi* and *Kakothrips* (*Physapus*) *robustus*. In June, horse-beans were injured by *Aphis rumicis* (*papaveris*), and attacks of *Grapholitha* spp. on peas were fairly common in July, but not to the same extent as in 1913. At Holstebro, the larvae of *Tipula paludosa* injured peas.

Pests of beet-roots and sugar-beets included *Silpha opaca*, which completely destroyed several fields, and at the end of June the larvae of *Hydroecia micacea*. *Aphis rumicis* appeared comparatively early in 1914, attacks on seed beets being reported at the beginning of June. On turnips and swedes, *Chortophila* (*Anthomyia*) *brassicae*, especially in June, before and after the thinning of the plants, did some injury, although generally speaking less than in 1913. At the same time at the Experiment Station a very serious attack of *Ceuthorrhynchus quadridens* took place, while *Phyllotreta nemorum* and *P. atra* were very destructive in many localities. All over the country, *Plutella maculipennis* (*cruciferarum*) was very numerous throughout the summer just as in 1905. In that year, however, the attack lasted only a comparatively short time, whereas in 1914 several generations injured the turnips until the end of August and the beginning of September, when *Entomophthora radicans* made its appearance and killed the remaining larvae. Spraying with Paris green or nicotine was effective against this pest. *Aphis brassicae* was fairly common during August

and September on seed-turnips and on one-year-old turnips. From the middle of April, *Meligethes aeneus* appeared, and in May did some damage to seed turnips and white cabbage. It was controlled by collecting the beetles with tarred cloth. At Kolding an attack of *Psylliodes chrysocephala* on seed-turnips was noticed. Carrots in some localities were injured by *Psila rosae*. Potatoes were attacked by *Calocoris norvegicus* (*bipunctatus*), by *Eurydema oleraceum* and the larva of *Hydroecia micacea*. *Sitones lineatus* was present throughout the summer and *Hypera* (*Phytonomus*) *nigrirostris* was noticed both in March and June; damage was also done by *Apion apricans* and *Cecidomyia loti*. At Tystofte in the early summer clover was severely damaged by *Forficula auricularia*. *Tylenchus devastatrix*, as usual, occurred in many parts of the country and, combined with the drought, largely ruined the clover. *Aptinothrips rufus* occurred in great numbers on several grasses, as well as *Trachea secalis* and *Agrotis pronuba*. The larvae of *Euxoa* (*Agrotis*) *segetum* and possibly other species were exceedingly common and in many places injured the root-crops. The larvae of *Pieris brassicae* were in some places controlled with arsenical sprays and in some cases the cabbage crop was saved in this way. Against *Heterodera schachtii*, nitrogenous fertilisers were used, in several instances with success.

The two following abstracts are taken from **«Вѣстникъ Русской Прикладной Энтомологіи.»** [*Messenger of Russian Applied Entomology*], *Kiev*, ii, no. 1, 1915, by permission of the Editors.

BORODAJEVSKY (P.) **Что день грядущій намъ готовитъ?** [What has the morrow in store for us?]—**Лѣсопромышленный Вѣстникъ.»** [*The Forest-trade Messenger*], xvi, no. 16, 1914, pp. 217–218.

In the privately owned forests in the government of Minsk, the fallen timber is only rarely removed. This leads to the breeding of large numbers of *Myelophilus piniperda* and *M. minor*. As a result, favourable conditions are artificially created for the subsequent large outbreaks of such pests as *Dendrolimus pini*, L., and *Lymantria* (*Ocneria*) *monacha*, L. Attention is called to the possibility of outbreaks of these moths in 1914 and 1915 and the necessity for protection of the forests from them.

GRATCHOV (A. V.). **Къ вопросу о бактеріальномъ способѣ борьбы съ саранчей. Рефератъ доклада А. В. Грачова, сдѣланнаго въ засѣданіи Петроградскаго Микробіологическаго Общества, 31-го января 1914 г.** [On the question of the bacterial method of controlling locusts. Abstract of a paper read by A. V. Gratchov at the meeting of the Petrograd Microbiological Society on the 13th February 1914.]—**«Журналъ Микробіологіи.»** [*The Journal of Microbiology*], 1914, nos. 1–2, p. 175.

From the experiments of the author in Algeria and in Astrachan and from the work of N. P. Ponomarev in Bokhara, it is clear that various species of locusts are not equally susceptible to *Coccobacillus acridiorum*, d'Herelle. It is nevertheless possible to adapt the virus by special preparation to suit various species of locusts. The author, contrary to the methods of d'Herelle and of the Pasteur Institute of

Algeria, suggests passing the bacillus directly from dead insects of one series into those of another without any intermediate cultivation of fluid on agar-agar. In this way, there is no danger of losing the virus, which may happen when using the method of d'Herelle, and at the same time its virulence is increased.

DYCHOV (N.). **Карболовая кислота противъ медяницы.** [Carbolic acid against Psylla.]—**«Садъ, Огородъ и Бахча.»** [*Orchard, Market-Garden and Bachza*], *Astrachan*, no. 5, May 1915, pp. 192–194. [Received 27th September 1915.]

For the control of *Psylla*, spraying with a solution of carbolic acid, prepared as follows is recommended : —3 lb. of green soap are dissolved in about 3 gallons of warm water, after which about $1\frac{1}{2}$ gallons of black carbolic acid are added and the whole diluted with from 40 to 45 gallons of cold water. This insecticide provides the most effective and cheapest remedy for the destruction of the eggs of this pest, and does not injure the bark of the trees. During the successful application of this remedy in some orchards of the district of Kurmysh in 1914, it was observed that apple scab has diminished in comparison with the orchards where no carbolic acid was sprayed, and that lichen and moss were also destroyed.

PROCHOROV (J.). **О борьбѣ съ вредителями.** [On the control of pests.] **«Садъ, Огородъ и Бахча.»** [*Orchard, Market-Garden and Bachza*], *Astrachan*, no. 8, August 1915, pp. 366–368.

Against Aphids, *Psylla mali* and *Hyponomeuta malinellus*, spraying with an arsenical tobacco liquid has been successful. This is prepared by boiling a given quantity of tobacco dust in a boiler for 2, 3 or 5 hours and, after the decoction has cooled down and been strained, diluting it with water in the proportion of about 5 gallons of water for each 1 lb. of the tobacco used, and adding a solution of arsenic made by boiling 1 lb. of arsenic in about 5 gallons of water, such that each 27 gallons of the liquid for use should contain $1\frac{1}{2}$ oz. of arsenic.

SACHAROV (N.). **Къ появленію лугового мотылька въ Черноярскомъ уѣздѣ и въ окрестностяхъ Владиміровки, Царевскаго уѣзда.** [On the appearance of *Phlyctaenodes sticticalis*, L., in the Tcherny-Yar district and near Vladimirovka, in the Zarev district.]—**«Садъ, Огородъ и Бахча.»** [*Orchard, Market-Garden and Bachza*], *Astrachan*, no. 8, August 1915, pp. 373–380.

This is a report to the Zemstvo of the government of Astrachan on investigations into the outbreak of *Phlyctaenodes sticticalis* which occurred in 1915. The chief damage was done to mustard and bachza crops ; melons and pumpkins were not touched. No damage was done to orchards and market-gardens ; some grain crops were uninjured and only young seedlings of sorghum and maize were more or less seriously damaged ; at the same time the caterpillars destroyed all the weeds in the fields invaded by them and also devoured leaves of rye and wheat, without, however, causing any serious damage to these crops. The caterpillars mainly pupate in friable soil, mostly in soil under cultivation, mustard and bachza fields being the most infested.

Only 3·2 per cent. of the caterpillars appeared to be infested with parasites; *Apanteles* sp. was not found and only small numbers of *Calosoma* were present. There was no evidence of sterility in the females due to the disease which is produced by the fungus *Microklossia prima.*

Kolossov (J. M.). **Энтомологическія замѣтки.** [Entomological Notes.]—**«Записки Уральскаго Общества Любителей Естествознанія.»** [*Bulletin de la Société Ouralienne d'Amis des Sciences Naturelles*], *Ekaterinburg*, 1915, xxxv, nos. 1–3 and 4–5, pp. 16–17.

According to Fabre, the Curculionidae are especially preyed upon by wasps of the genus *Cerceris*, which catch them as food for their larvae. In Russia, in the government of Tver, the author found in dry places numbers of nests of *Cerceris quadrifasciata*, Panz., along the sides of the roads, which contained quantities of *Strophosmus capitatus*, Deg. (*obesus*, Marsh.), caught on the neighbouring pines (*Pinus sylvestris*). In this locality *S. capitatus* is by no means rare and damages the buds, young shoots and even, according to Cholodkovsky, attacks the bark of many trees.

Luchmensky (V. I.). **Практическое Огородничество.** [Practical Market-Gardening.] Supplement to the Journal **«Плодоводство.»** [*Fruit-growing*], *Petrograd*, 1915, 64 pp., 13 figs.

One chapter of this book is devoted to the control of insect pests, including *Gryllotalpa gryllotalpa* (*vulgaris*), *Haltica* spp., caterpillars of *Mamestra* (*Barathra*) *brassicae* and *Pieris brassicae*, cabbage Aphids, *Ceuthorrhynchus* sp. and *Chortophila brassicae*. As remedies against the larvae of the last two pests, burning the roots of the affected plants or digging into the soil near the roots balls of cotton waste moistened with kerosene and carbon bisulphide, are recommended.

Afanasiev (A. P.). **Русское виноградство въ 1914 году (III-й вегетаціонный періодъ).** [Russian Viticulture in 1914. (The 3rd vegetative period)].—**«Вѣстникъ Винодѣлія.»** [*Herald of Viticulture*], *Odessa*, 1915, no. 7–8, July–August, pp. 289–320.

This is a continuation of the series of reviews of the state of viticulture in Russia in 1914 [see this *Review*, A, iii, pp. 477 and 602], and the information contained therein is based on 98 reports from 14 vinegrowing governments and provinces and refers to the last stage, the ripening and harvesting of the grapes. Except for *Phylloxera* in Bessarabia and Caucasia, practically no insect pests were noticed in the great majority of the localities under report, only the following being mentioned by some correspondents: *Clysia ambiguella*, Hb., in some parts of Bessarabia; *Phylloxera* in Cherson; *Polyphylla fullo*, L., and *Otiorrhynchus* sp., in Taurida and Kuban, where spraying with a 3 per cent. solution of barium chloride proved useless; *Polychrosis* (*Eudemis*) *botrana* and *Eriophyes* (*Phytoptus*) *vitis* in Astrachan.

MORDVILKO (A.). **Гороховая тля.** [The Pea Aphis.]—**«Труды Бюро по Энтомологіи Учен. Ком. Глав. Управ. З. и З.»** [*Memoirs of the Bureau of Entomology of the Scientific Committee of the Central Board of Land Administration and Agriculture*], *Petrograd*, vol. viii, no. 3, 1915. Second, revised and enlarged edition, 54 pp., 2 plates, 4 figs.

Pisum sativum is attacked by only one species of Aphid, viz., *Acyrthosiphon* (*Macrosiphum*) *pisi*, Kalt., and there is no doubt that all descriptions of Aphids observed on peas deal with one and the same species. Kaltenbach, who was the first to describe it, evidently did not fully realise the difference between this species and those found on *Geum urbanum* and *Spiraea ulmaria*, as he includes both these in the list of its food-plants. *Aphis onobrychis*, found and described by Boyer de Fonscolombe in 1841 on *Hedysarum onobrychis*, is also the same species. Kaltenbach treated as a synonym of *Aphis pisi*, *Aphis ulmariae*, Schr., found on flower stems of *Spiraea* (*Filipendula*) *ulmaria* and consequently some of the later authors called the pea aphis, *Siphonophora ulmariae*, Schr. Professor Cholodkovsky has, however, pointed out that *Aphis ulmariae* is quite a distinct species. The species discovered by Cholodkovsky on *Spiraea ulmaria* is, however, a species of *Macrosiphum*, while there is no doubt that Schrank had before him a species of *Aphis*, and therefore the author proposes to call the species of Cholodkovsky, found on the flowers and beneath the leaves of *Spiraea ulmaria*, *Macrosiphum cholodkovskyi*. The Aphid found on *Caragana arborescens* (Siberian pea-tree) has also been confused with the pea aphis, but is a distinct species, *Acyrthosiphon caraganae*, Chol. The author has erected the genus *Acyrthosiphon* for the pea aphis and its allies, and he describes and figures its characteristic features. All the species of the genus *Acyrthosiphon* live chiefly on grasses, preferably on their stems, less frequently underneath the leaves ; only a few species such as *A. caraganae*, breed on bushes. No Aphids with a long cauda are visited by ants, and as this fact deprives them of some protection offered by the ants, they have adopted some other devices for defence, such as dropping rapidly when disturbed ; protection is also afforded by their colour and the presence of long and partly movable tubercles producing a waxlike substance, which clogs the mandibles of an enemy. A key is given to the species of *Acyrthosiphon*, which, in addition to *A. pisi* and its subspecies, includes *A. orientale*, Mordv. ; *A. norvegicum*, Mordv. ; *A. kamtshatkanum*, Mordv. ; *A. caraganae*, Chol. ; *A. vassilievi*, sp. n., from the underside of leaves of pumpkins in Turkestan ; *A. emelianovi*, Mordv. ; *A. gossypii*, Mordv., from cotton, and *A. gossypi paczoskii*, subsp. n., from stems of *Lepidium perfoliatum* ; *A. skriabini*, Mordv., from *Malva neglecta* ; *A. dubium*, Mordv., from Papilionaceous plants in the delta of the Volga ; *A. loti*, Theob. ; *A. cyparissiae*, Koch, and *A. navozovi*, Mordv. The various stages are described, including the stem-mother, the summer wingless parthenogenetic female, the autumn winged parthenogenetic female and the sexual forms. A comparison of the specimens of wingless and winged parthenogenetic females, collected from *Ononis hircina* in Volhynia and Cherson, with those taken from peas, have demonstrated the fact that *Siphonophora ononis*, Koch, is also a synonym of

A. pisi. The parthenogenetic females are all viviparous; an adult female can produce from 100 to 150 descendants during its life, from 4 to 13 individuals being born daily on blossoming peas and from 3 to 10 on clover. The young mature in about 8 to 10 days, according to the temperature. The amount of food determines whether a wingless individual (when food is abundant), or a winged one (when food is scarce), will be produced. With regard to sexual forms, the author has never found males and females on *Pisum sativum*, *Vicia cracca* (wild vetch) or *Lathyrus odoratus* (sweet pea), only on *Lathyrus latifolius*, *L. ensifolius*, *Medicago falcata* and *M. sativa*; these were found during September. These sexual females lay their eggs singly, about 10 in all, on leaves, stems and fruits of *Lathyrus*, *Medicago*, *Trifolium*, *Onobrychis* and *Ononis*.

The subspecies *Acyrthosiphon pisi pisi*, to which the remarks of the author refer, occurs all over Europe, in Siberia, and the Altai. *A. pisi destructor*, Johns. is found in the United States and Canada and closely resembles the type form. *A. pisi turanicum*, Mordv., found in Transcaspia and Turkestan, is more distinct from it and more nearly resembles *A. pisi ussuriensis*, Mordv. It is not yet known which subspecies occurs in the Crimea and in the peninsulas of Southern Europe. It is evident that the distribution of these pests has not been assisted by man; their food-plants (peas, lucerne, clover, sainfoin, etc.) are grown from seed and therefore eggs laid on plants which are subsequently mown for hay, would perish. The insects found in European Russia, Siberia and on the Altai do not winter as parthenogenetic females, but as fertilised eggs; it is not yet known in what stage *A. pisi turanicum* winters. The author's studies of the life-history of these Aphids since 1898 in various parts of European Russia have shown that the females lay wintering eggs on some species of *Lathyrus*, red clover, sainfoin and *Ononis*; these eggs produce in the following spring wingless stem-mothers, which develop on the new stems and shoots of these plants. No sexual females breed on *Lathyrus odoratus*, *Pisum sativum*, or *Vicia cracca*; the last stage on these plants is that of winged parthenogenetic females, which migrate to other plants, where they produce either a new parthenogenetic generation, if it is in summer, or sexual forms in September if on suitable plants. Thus, the development of sexual forms depends not only on the amount of food, but also on some unknown qualities of the food-plant. Aphids breeding on grasses usually appear later than those breeding on trees, which is partly due to the late development of grasses. The larval stem-mothers from the hibernating eggs, pass from the dry leaves and stems to new growth of the same plant or to some annual plant if suitable ones are present. Besides the stem-mothers, which are usually wingless in the case of all Aphids, their first descendants at least are also wingless; winged individuals only appear later, when the feeding conditions become less favourable; sometimes, however, even the wingless forms pass from one plant to another in search of more suitable food. Peas are usually attacked in June, the previous generations having bred on *Lathyrus*, *Medicago*, *Trifolium* and other annuals. If the peas have already blossomed, the damage is unimportant. These Aphids remain on peas until the pods have developed; winged forms then appear. *A. pisi* is the only

Aphid attacking peas, although it also breeds on other plants, mostly Papilionaceae, and may then be found in company with other species, such as *Megoura viciae*, Kalt., on *Lathyrus*, *Aphis craccae*, Kalt., on stems and petioles of *Ervum* (lentil) and *Vicia cracca*, and *A. capsellae*, Kalt., on *Capsella bursa-pastoris*. It is also found on some Umbelliferous plants, such as *Chaerophyllum temulentum* and *C. silvestre* (cow-parsley). It is not found on *Geum urbanum* or *Spiraea ulmaria*, and the author doubts the correctness of the statements that it occurs on *Urtica dioica* (nettle), *Phaseolus vulgaris*, *Tanacetum vulgaris* (tansy), *Artemisia absinthium* (wormwood), *Colutea* (bladder senna) or *Epilobium* (willow herb). Warm, wet weather is very favourable to the development of Aphids on peas, while cold weather, cold rains dry winds and droughts delay their development. Amongst the enemies of *A. pisi* are recorded Syrphid and Coccinellid larvae, adults of *Coccinella 7-punctata* and *C. conglobata*; the larvae of *Chrysopa* are rare amongst their colonies, as also is the Braconid parasite, *Aphidius ervi*, Hal. Although *A. pisi* is largely destroyed by heavy rains, experiments on submerging them in water showed that they are able to survive cold after a 12 hours' submersion; the action of rain is therefore probably a mechanical one in dislodging them from the plants. So far as European Russia is concerned, damage by Aphids to peas is limited to the south. Experiments in spraying with 1 per cent. or 2 per cent. solutions of lysol and with kerosene soap emulsion, gave negative results; the emulsion proved more injurious to the peas than to the Aphids, while the lysol, if strong enough to destroy the insects, also damaged the plants. The early sowing of peas may protect them from serious damage; they should also be sown amongst Graminaceous plants, and such others as are not attacked by *A. pisi* and as far as possible from meadows, bushes, roads, etc. In 1890 A. Vedeneiev recommended sowing peas mixed with hemp-seed (about 2 lb. to the acre) as practised by the German colonists in the government of Samara. A synonymy and bibliography is appended.

GONZALEZ (B.). **Informes sobre destrucción de la langosta.** [Notes on the destruction of locusts.]—*Rev. Agrícola, Bogotá*, i, no. 4, April 1915, pp. 210–211. [Received 13th September 1915.]

This report to the Colombian Minister of Agriculture and Commerce describes the destruction of locusts by Señor Francisco de A. Salive's "Insecticida Eureka." A strip of canvas, 22 yards long and 2 yards wide, was impregnated with the liquid and laid on the ground and a mass of locusts estimated to weigh about 2 cwt. was driven over it, their passage taking about 40 minutes. Fourteen hours later the locusts were dead. The cost of this application was about 6s. 3d.; the bulk of the insecticide diminished at the rate of 5 per cent. for every two hours required to contaminate a mass of locusts, but the insecticidal power of the solution was not impaired by exposure. According to another member of the inspection committee, about 1 cwt. of solution was used to impregnate the canvas, and direct contact with it killed the locusts within 24 hours.

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Enfermedades del mandarino; destrucción. [Diseases of the mandarino orange and control of the insect pests causing them.]—*Boletin Depart. Nacional Fomento. Asunción-Paraguay*, no. 6, July-September 1914, pp. 172–173. [Received 14th September 1915.]

This article records the infestation of mandarin oranges by scales, said to be *Lepidosaphes beckii* (*Mytilaspis citricola*) and *Coccus* (*Lecanium*) *hesperidum*. A kerosene-soap emulsion is the control advised.

Mezzasalma (A.). **Per limitare i danni della mosca olearia.** [To restrict the damage caused by the olive fly.] *Jl. Picentino, Salerno*, iv, no. 9, September 1915, pp. 381–383.

The ravages of the olive fly [*Dacus oleae*] still continue unchecked, in spite of the various controls adopted. In the low lying coastal districts, this insect appears earlier and completes a larger number of generations than in the hilly regions. The destruction of all early varieties of the olive in the coastal districts would therefore reduce the opportunities of breeding of this pest. Later in the season, the danger of infestation diminishes, as olives are not attacked when they are sufficiently mature to begin to contain oil.

Cambi (G.). **Il "punteruolo" ed il "fleotripide" dell'olivo** (*Phloeotribus scarabaeoides* e *Phloeothrips oleae*) **nel Chianti.** [*Phloeotribus scarabaeoides* and *Phloeothrips oleae* in the Chianti district.]—*Riv. Agric., Parma*, xxi, no. 38, 17th September 1915, p. 601.

This article is an abstract from the author's original in *L'Agricoltura Pisana*. The existence of *Phloeothrips oleae* is dependent upon that of *Phloeotribus scarabaeoides*, Bern. (*oleae*, F.), as it hibernates in the galleries of the latter. Control of the Scolytid should therefore prove effective against both insects.

de la Mare Norris (F.). **Report on locust work—January, February, March 1915.**—*Agric. Bull. Fed. Malay States, Kuala Lumpur*, iii, no. 8, May 1915, pp. 291–293.

In the districts of Selangor and Negri Sembilan and in the State of Johore, 351 swarms were taken with the bag-trap, the locusts filling 5,226 petroleum tins. A further 119 swarms were poisoned in Negri Sembilan. These figures cover the first three months of 1915.

South (F. W.). **A summary of locust work in 1914.**—*Agric. Bull. Fed. Malay States, Kuala Lumpur*, iii, no. 8, May 1915, pp. 293–297.

During 1914, 68,487 four-gallon kerosene tins of hoppers were destroyed in the districts of Selangor, Negri Sembilan and Pahang. These represented 4,218 swarms. In addition, 3,392 swarms were poisoned and a further 250 swarms were destroyed at Temerloh. The total cost of the work for the year was £9,466 against an estimated expenditure of £12,250. The expenditure included the cost of the necessary sprayers and of the repairs and replacement of all the

(C222) Wt.12/91. 1,500. 12.15. B.&F.Ltd. Gp.11/3. A

apparatus. In the State of Johore, the total number of swarms destroyed was 330. The results of the year's work may be considered as satisfactory, as in Selangor and the Negri Sembilan the locusts have certainly been reduced in numbers and a beginning has been made with their destruction in Johore. It would appear that on the whole the number of locusts present in the entire Malay Peninsula has been considerably reduced.

WILSON (C. C.). **Sandalwood.**—*Indian Forester, Allahabad*, xli, no. 8. August 1915, pp. 247–251.

A grub boring in the heartwood of a branch of a sandal tree, was found in November 1913, and the imago, which hatched out in May 1914, was identified by the Forest Research Institute, Dehra Dun, as an unknown species of LAMIIDAE. According to Stebbing, the borers attacking sandal are *Zeuzera coffeae*, *Sirex* sp., and *Stromatium* sp. The last-named was afterwards thought to be a species of *Coelosterna*, but the description given corresponds with the appearance of the Lamiid here reported.

BEESON (C. F. C.). **Notes on some Indian forest beetles.**—*Indian Forester, Allahabad*, xli, no. 8, August 1915, pp. 294–299.

During the compilation of Stebbing's "Indian Forest Insects of Economic Importance, Coleoptera" [see this *Review*, Ser. A, iii, p. 154] the investigations carried out with some species have supplied further information necessitating some alterations. Corrections in the nomenclature are here dealt with, especially as regards species of considerable economic importance, which are beginning to appear in departmental literature under incorrect specific names. The Cerambycid, *Tetropium oreinum*, Gahan, has been wrongly recorded as *Trinophylum cribratum*, Bates. An examination of a long series of the Scolytid, *Sphaerotrypes siwalikensis*, Stebbing, has convinced the author that *S. assamensis* is a synonym of that species. *Xyleborus bengalensis*, Stebbing, is a synonym of *X. semigranosus*, Blandford. *Crossotarsus saundersi*, Chap., or possibly a local variety of it, is without doubt the species referred to as *Diapus heritierae*, Stebbing. From material collected in 1906, 1909 and 1912, Col. Winn-Sampson described two new species of PLATYPODINAE, *Diapus furtivus* and *Diapus mirus*. Recent field-work shows that these two species are identical and that the sexes in both cases have been wrongly interpreted; the former name has priority.

COCKAYNE (A. H.). **The subterranean grass-caterpillar.**—*Jl. Agric., Wellington, N.Z.*, xi, no. 1, 20th July 1915, pp. 13–17, 4 figs.

Widespread damage to grass land is caused by subterranean grass-caterpillars, the larvae of moths of the Hepialid genus *Porina*. *P. umbraculata* and *P. cervinata* are the two most destructive species and have been present in enormous numbers in the Wellington district, about 40 to the square yard having been counted. The larvae burrow into the soil and remain during the day at a depth of 1 to 6 inches.

At night they come to the surface and feed on the herbage on a level with the ground. While feeding, they cover themselves with a protective film of soil-particles loosely held together with strands of silk. The larvae of these two species are very similar and vary from $1\frac{1}{2}$ to 4 inches in length. Pupation normally occurs about September and the moths are on the wing from the latter part of October until well on in the new year. The larvae are voracious feeders, and when they are at all abundant, large bare patches are formed. In many instances the damage is attributed to the grass-grub, but the ground on land infested with *Porina* is not so spongy to the tread as when *Odontria* larvae are plentiful. Again, the casts formed when the larvae are feeding are always seen dotted about the surface of the ground. These casts superficially resemble those of earth-worms, but are much more friable and are also loosely held together by the silk. Injury is often done to various vegetable and root crops, such as potatoes and turnips. *Porina signata* is common in flax [*Phormium tenax*] swamps, and bores large holes in the butts of the flax plants, often causing an injurious rot to develop. In controlling the pest on small areas, such as lawns, the following method of using carbon bisulphide gave good results: three parts of carbon bisulphide were mixed with one part of phenyl, and 2 oz. of this mixture was used in 2 gals. of water for every square yard of ground treated. The dilute emulsion was poured on the surface of the ground with an ordinary watering can, and within twenty-four hours all the larvae were killed without any injury being done to the grass. This method is not, however, suitable for large areas.

Jarvis (E.). **Report to the Bureau of Sugar Experiment Stations.**—*Queensland Agric. Jl., Brisbane*, iv, no. 2, August 1915, pp. 92–93.

The larva of an undetermined Elaterid beetle, which occurs sparingly in volcanic and sandy soils around Gordonvale, attacks both adult and grub forms of the cane beetle. A specimen collected on 6th November 1914, killed and devoured no less than 126 large cane grubs and 4 grey-back beetles during a period of seven months, and was still in the larval stage on the 4th June 1915 and as greedy as ever.

Scott (W. M.). **New developments in spraying materials.**—*Rept. Maryland State Hortic. Soc., College Park, Md.*, xvii (1914), 1st March 1915, pp. 95–104. [Received 20th September 1915.]

There has long been a desire to substitute dry lime sulphur or its equivalent for lime-sulphur solution, owing to its objectionable bulk. A substitute was found in barium [see this *Review*, Ser. A, iii, p. 118] as a carrier for the sulphur, with which it forms similar compounds. The expectation that barium-sulphur would have the same insecticidal and fungicidal properties as lime sulphur was fully realised. In a number of experiments conducted against the San José scale [*Aspidiotus perniciosus*] in six different States, varying in climatic conditions from Georgia to New York, no instance was observed of any material difference in the insecticidal effects of barium-sulphur and lime-sulphur. The results of an experiment conducted at Hancock,

Maryland, are tabulated. Three-year-old apple and peach trees badly infested with this scale were used, and the application was made on 25th and 26th March 1914. Dry barium-sulphur was used at the rate of 16 lb., 24 lb. and 32 lb. to 50 U.S. gals. On 30th May, 99½ per cent., 100 per cent. and 100 per cent. respectively of scales were dead, and on 4th July no young scales were seen to be alive. The percentage killed was also 99½ when only 10 lb. had been used. The lime-sulphur solution of 33° Bé. was diluted at the rate of 5½ gals. to 50 gals., and on this plot 99¾ per cent. of the scales were dead on 30th May, while no young scales were alive on 4th July. On the unsprayed control plot, only 50 per cent. of scales were dead on the former date and very many young individuals were seen on 4th July. This similarity of result was again noticed in the control of other Coccids; they both controlled oyster shell scale [*Lepidosaphes ulmi*] and had no effect on peach Lecanium [*Eulecanium persicae*] or terrapin scale [*E. nigrofasciatum*]. It is well known that lime-sulphur will not control the latter. Another experiment showed that barium-sulphur has decided fungicidal properties and that it may prove to be even less injurious to foliage than lime-sulphur solution.

Arsenate of lime is another new insecticide worthy of consideration as a possible substitute for arsenate of lead, as it appears to be equally efficient, so far as one season's tests can determine [see this *Review*, Ser. A, iii, p. 447]. In a foliage test on peach trees 1½ lb. of arsenate of lime was diluted in 50 U.S. gals. water and almost defoliated the trees, while arsenate of lead used on this same variety caused very little injury. This test showed that arsenate of lime is more likely to injure susceptible foliage than arsenate of lead. Apart from this, it appears that for spraying apple and shade trees, arsenate of lime may be used with the same degree of efficiency and safety as arsenate of lead, and unless some unsuspected objection to this new insecticide arises, it would seem a waste of money to continue the use of the more expensive poison.

Cory (E. N.). **Insect pests of 1914.**—*Rept. Maryland State Hortic. Soc., College Park, Md.*, xvii (1914), 1st March 1915, pp. 104–112. 1 plate. [Received 20th September 1915.]

Cirphis (*Leucania*) *unipuncta*, Say, (army worm) destroyed grain and forage crops in various parts of Maryland in 1914. Poison bran mash was used against the injurious second brood. In several places where it was not controlled, the third brood proved injurious about 10th October. *Mayetiola* (*Cecidomyia*) *destructor*, Say, (Hessian fly) continued to be injurious. *Cephus pygmaeus*, L., (wheat-stem sawfly) and *Meromyza americana*, Fitch, (wheat-stem maggot) are recorded for the first time. Corn root worms (*Crambus* sp.) and wireworms did considerable injury to maize near Elkton. *Sitotroga cerealella*, Oliv., (Angoumois grain moth) was unusually abundant in maize and wheat. *Epicauta cinerea*, Fors. (grey blister beetle) caused considerable damage to the lucerne crop of one grower. *Tischeria malifoliella*, Clem. (trumpet leaf-miner of the apple) seemed to be on the increase. *Eriosoma* (*Schizoneura*) *lanigerum*, Haus., (woolly aphis) continued to be one of the most injurious apple pests. Pine tar creosote, either undiluted or in emulsion made with caustic soda, should be sprayed about the

bases in trenches with a radius of about 3 feet and to a depth exposing the roots. The small yellow ant, *Lasius interjectus*, Mayr, was noticed tending and transporting these Aphids from place to place. Paradise stocks seemed to have a considerable degree of immunity. *Taeniothrips pyri*, Daniel, (California pear thrips) was the most important insect of the year in Maryland. It was discovered by Mr. W. M. Scott in an orchard near Baltimore. It had previously been found only in England, California and the Hudson River valley. *Diabrotica 12-punctata*, Oliv. (twelve-spotted cucumber beetle) did considerable injury to young peach foliage and buds. *Phylloxera vastatrix*, Planch. (grape Phylloxera) were found infesting grape vines received from a nursery. Scale-insects reported as doing local damage on fruits, included: *Eulecanium* (*Lecanium*) *nigrofasciatum*, Perg., on peach; *Lepidosaphes ulmi*, L., on Persian walnut; and *Pulvinaria vitis*, L., on grapes. Bean pests were very injurious; *Sitones hispidulus*, F., attacked newly-planted Lima beans, which also suffered injury from *Chortophila* (*Pegomyia*) *fusciceps*, Zett.; *Ceratoma trifurcata*, Forst., damaged wax beans. *Lixus concavus*, Say, (rhubarb weevil) was abundant, but did no serious injury. Its native food-plant is dock, and this weed should be eradicated from market-gardens. *Murgantia histrionica*, Hahn, was reported from Salisbury as extremely injurious to horse-radish, which was planted next to cabbage, the latter remaining practically untouched by these bugs, which are a common cabbage pest. The Eumolpid, *Nodonota puncticollis*, Say, injured roses extensively. The Arctiid, *Diacrisia virginica*, F., and *Chloridea obsoleta*, F., did considerable damage to geraniums in greenhouses near Baltimore. The greenhouse Orthezia [*Orthezia insignis*] badly infested Colias in one of the parks in Baltimore; Black Leaf 40 proved an efficient control. Mining Dipterous larvae, probably *Phytomyza aquilegiae*, Hardy, infested the leaves of hybrid Aquilegias on the Experiment Station grounds. *Psylla buxi*, Reaum. (boxwood Psylla) injured box at Baltimore. Shade-tree pests included: *Chrysomphalus obscurus*, Comst., and *C. tenebricosus*, Comst., on white oak and soft maple respectively; *Pulvinaria acericola*, W. & R., *Prociphilus tessellata*, Fitch, and *Aleurochiton forbesii*, Ashm., on maple; and *Psylla* (*Trioza*) *diospyri*, Ashm., on persimmon. The caterpillars of *Papilio ajax* did considerable injury to papaw foliage on young plants in the Experiment Station nursery. The Hispid, *Chalepus dorsalis*, Thunb., and *Gallerucella luteola*, Mull., continued to do considerable damage to black locust and to elms.

CONRADI (A. F.) & EAGERTON (H. C.). **The spotted click beetle** (*Monocrepidius vespertinus*, **Fab.**).—*South Carolina Agric. Expt. Sta., Clemson College*, Bull. no. 179, December 1914, 8 pp., 2 plates. [Received 21st September 1915.]

When studying the life history of *Horistonotus uhleri* in Colleton County, S.C., in 1912 and 1913, *Monocrepidius vespertinus*, F. (spotted click beetle) was also found in great abundance. Since then it has been observed in other parts of South Carolina. In Colleton County, its larva was found associated with that of *H. uhleri* and is believed to have been responsible for at least 15 per cent. of the damage formerly

attributed to that pest. It would seem that the larva prefers cotton seed and young cotton roots to the seed or young roots of maize, which it often seriously attacks in the absence of the former. Unlike that of *H. uhleri*, the larva of *M. vespertinus* seems to be abundant on almost any type of soil. The chief damage is generally done on sandy uplands. The eggs are laid on or near the surface of the soil and hatch in about 9 to 10 days in July and about 20 in September. The larvae at once begin their search for food; they do not usually go deeper into the soil than 3 to 3½ inches, but during dry weather in the spring of 1914, they occurred at 5 to 6 inches below the surface. A few individuals can do a great deal of damage in a newly planted tobacco field by boring through the plants. They are somewhat cannibalistic and often appear to attack pupating insects. The pupa is formed in a cell in the soil 3 to 5 inches below the surface. The beetles do not fly freely before sunset, differing from *H. uhleri* in this respect. An average life-cycle takes 330 days: 12 for the egg, 305 for the larva and 13 for the pupa. A nightjar, probably *Chordeiles virginianus*, exercises natural control, the elytra of the beetles being frequently found in its excreta in a field of maize where thousands of these insects had congregated. A common field spider, *Peucetia viridans*, Htz., which in autumn frequents the tops of maize, is another enemy of no small importance. The Reduviid bug, *Apiomerus crassipes*, F., and an Asilid fly, *Proctacanthus brevipennis*, Wied., have been seen to prey on these beetles. Autumn and winter ploughing are the artificial control advised. In a rotation of cotton, maize and oats, the oat stubble should be left undisturbed after harvest, as the adults do not frequent such fields for oviposition. After 15th September any desired procedure may be followed in preparing for autumn cover crops, as practically all eggs have been laid before this date. Although this practice on any given field occurs only once in two or three years, it is believed to be effective in controlling this pest. Where *M. vespertinus* is injurious to tobacco, a handful of cotton seed placed half way between the plants will keep the insect away from them until they become sufficiently strong to withstand attack.

Collins (C. W.). **Dispersion of gipsy-moth larvae by the wind.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 273, 24th August 1915, 23 pp., 6 plates, 1 map.

In 1893, Wachtl and Kornauth described the aerostatic setae of the first-stage larvae of *Lymantria* (*Porthetria*) *dispar*, L. (gipsy moth) and *L. monacha*, L. (nun moth), and suggested that these aerophores assist in the dissemination of the young larvae through the air. The latest observations on this subject were published by Shcherbakov in 1914 [see this *Review*, Ser. A, iii, p. 43] and establish the fact that these larvae are capable of soaring in a slight wind.

In 1913, as a result of several experiments conducted along the coasts of Massachusetts and New Hampshire and on the hills of the latter State by using tanglefooted screens and cloth for traps, there were caught on 977 square feet, 289 first-stage larvae of *L. dispar* which had been carried by the wind from 220 yards to 1 mile or more; in 1914, on 1,614 square feet of sticky surface, 346 larvae were taken

which had been blown from 220 yards to 13½ miles or more, as verified by the wind records taken at or near those points. Three larvae were also taken from two large screens on the hills of New Hampshire during 1914. The screens used on the coast were of ¾ inch mesh poultry-wire fastened to posts 12 feet high. Considering the great numbers of larvae taken in the above experiments, there can be no doubt that the wind is almost wholly responsible for the general spread of *L. dispar* in New England. To prevent continual spread by the wind into new territory the badly infested areas near the border must be brought under control either by natural enemies, or hand methods, or both. The former are now playing an important rôle in the control of this insect in the greater part of the infested territory. The larvae are sufficiently active and allow themselves to be transported by the wind at temperatures of 55° F. and above, and have been caught at wind velocities varying from 2 to 23 miles an hour, although more active spread takes place when the temperature ranges from 65° to 85° F. and when the velocity reaches 8 miles or more an hour. Larvae are involuntarily carried by sudden gusts of wind when the temperature reaches 50° to 55° F., at which temperatures they often start crawling. By far the larger number of larvae were borne by combinations of west winds. The general progress of the species since its establishment at Medford, Mass., at the rate of 5 miles per annum to the north-east and at the rate of 3 miles per annum westwards from Providence, R.I., since its first appearance there in 1901, tends to verify the data collected in connection with the screen experiments. A bibliography of eight works is appended to this paper.

SEVERIN (H. H. P.), SEVERIN (H. C.) & HARTUNG (W.). **The Stimuli which cause the Eggs of the Leaf-ovipositing Tachinidae to hatch.**—*Psyche, Boston, Mass.*, xxii, no. 4, August 1915, pp. 132–137.

Eggs of *Chaetogaedia monticola*, Bigot, were obtained from adults kept under slightly moist conditions and supplied with food consisting of banana pulp and sugar. Experiments were performed to determine whether the eggs would hatch in the juices emitted from the mouths of a number of the normal hosts. Hatching took place readily in the green alkaline liquid ejected by larvae of *Cirphis* (*Heliophila*) *unipuncta*, Haw., *Vanessa cardui*, L., and *Phytometra* (*Plusia*) *chalcites*, Esp. A similar experiment was performed with *Anosia plexippus*, L. (milkweed caterpillar), from which this parasitic fly has not been bred, but the eggs nevertheless hatched. Many eggs failed to hatch in acid media, obtained from the body fluid of *C. unipuncta* and *A. plexippus* and from blades of grass on which the eggs had been deposited. Immersion in sodium hydroxide solution (0·1 and 0·05 per cent.) and in distilled water caused emergence of the larva in from 36 to 60 hours. Since many eggs of *C. monticola* hatched in one minute in the juices ejected from the host, Townsend's view that the juices act on the chitin and cause the shell to weaken is probably incorrect. In all probability the digestive juice of the host is perceptible to the larva through the micropyle of the egg and it immediately endeavours to free itself.

Ehrhorn (E. M.). **Report of the Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu,* xii, no. 8, August 1915, pp. 215–216.

Of 18,905 parcels examined in June 1915, 18,864 were passed as free from pests, while 2 were fumigated, 38 burnt and 1 returned. The following parasites were reared and distributed: Bred—*Tetrastichus*, 24,510; *Diachasma fullawayi*, 1,123; *D. tryoni*, 644; African *Spalangia*, 4,000; other species, 5,000. Liberated—*Tetrastichus*, 24,300; *D. fullawayi*, 1,162; *D. tryoni*, 646; African *Spalangia*, 2,000; *Opius humilis*, 200; Philippine *Spalangia*, 2,500; Philippine Pteromalid, 1,100; parasites of African hornfly, 200. A total of 44,200 pupae were used in rearing these parasites.

Sander (A.). **Deutschlands Kampf mit dem Kartoffelkäfer.** [Germany's struggle with the potato beetle.]—*München-Gladbach,* 1914, 46 pp., 5 plates, 1 fig.

The Colorado beetle [*Leptinotarsa decemlineata*] was first found in Germany near Cologne in June 1877. A much more dangerous outbreak occurred in the same year near Torgau in Saxony. Drastic measures were employed, even troops being utilised in exterminating the pest. In 1887 there were one or two minor outbreaks which were eradicated without much difficulty. A short account of the outbreaks in America is given and the German ordinance of 26th February 1875 against the importation of American potatoes or any parts thereof or of any sacks or other containers which may have held American grown potatoes, is quoted at length. Every country in Europe protected itself by a similar regulation in the same year. The most recent appearance of this pest in Germany occurred at Stade on the Elbe on the 9th July 1914, and by the 20th July about 7 acres were attacked. The beetles were collected in metal receptacles filled with leaves and haulms, soaked in benzol and burned; the land was dug to a depth of about 8 inches, the potatoes collected and examined and the soil well harrowed and sprinkled with crude benzol and petroleum at the rate of 3 quarts to the square yard; in all more than 50 tons of benzol were used. No one was allowed to leave the attacked area until his clothing had been thoroughly disinfected, nor was anyone allowed to enter it from the outside. The labourers' boots were washed with milk of lime. Soft soap was used for washing the hands, and all who had suffered from the handling of the beetles were treated with boric ointment. The operations were completed by the end of July at a cost of £2,500.

Smith (G. P. D.). **Bee Diseases.**—*Third Rept. of the Government Bureau of Microbiology, for the year 1912, Sydney,* 1914, pp. 134–135.

Throughout the year specimens of bees affected with the Isle of Wight bee disease, *Nosema apis*, were received. The bees suffered from a form of paralysis or from dysentery. Examination of the faeces usually revealed the presence of large numbers of spores of *N. apis*.

KEUCHENIUS (P. E.). **Entomologische Aanteekeningen.** [Entomological Notes.]—Reprint from *Teijsmannia, Batavia,* no. 3, 1915, pp. 166–169.

A disease of the leaves of *Hevea* has been observed in the eastern end of Java which is apparently due to *Tetranychus bioculatus.* Bernard in 1907 drew attention to the possibility of this mite becoming a more or less serious pest of *Hevea.* Spraying with California mixture or soft soap and tobacco extract is suggested as a remedy. Young *Hevea* slips, soon after planting out, have been found to be bored by a bee at the top of the cut surface; this has been identified by Dr. Koningsberger as *Ceratina viridissima,* Dalla Torre. It has long been known that the end of a *Hevea* cutting rots and dies and it is in this dead material that the insect lives; it has not as yet been found boring into the pith. It frequents dadap, lamtoro and *Jatropha curcas* (physic nut). Pisang (a kind of banana), in and about Besoeki, is constantly attacked by *Bactrocera ferruginea,* and the author has obtained 11 flies from one fruit of "pisang soesoe" which is apparently the preferred variety; this fly also infests mango, capsicum, coffee, sapodilla and *Eugenia* sp.

KEUCHENIUS (P. E.). **Korte aanteekeningen over ziekten en plagen.** [Short Notes on Diseases and Pests.]—*Medel. Besoekisch Proefstation, Djember,* no. 15, 1915, pp. 13–21.

The termite, *Coptotermes gestroi,* Wasm., locally known as Hevea-rajap, is by no means uncommon in Java and may possibly become a serious pest. Though it generally occurs in dead wood, living wood is also attacked. In the Federated Malay States the Universal Ant Destroyer has been used with great success against it. The Java planters at first were disinclined to use this apparatus, as the termites are not directly killed by it, but the policy of lending the apparatus carried out by the Station has to some extent removed their objections.

A reliable adhesive material for catching insects is needed in the tropics, the objection to the preparations in use in Europe being that they contain much linseed oil and consequently dry very rapidly in the sun and heat. The following mixtures have been found more or less free from this objection, the figures indicating parts by weight:—(*a*) 110 resin, 20 lard, 20 castor oil and 10 turpentine; (*b*) 4 yellow wax, 60 resin, 4 linseed oil and 25 castor oil.

On a large coconut plantation on which rewards are given for the collection of beetles, those brought in consisted chiefly of *Oryctes nasicornis*; not a single specimen of *Rhynchophorus ferrugineus,* Ol. (*signaticollis,* Chevr.), occurred, and it was suspected that the coolies had not taken the trouble to look for them. In the hope of getting a considerable number, the author offered increased pay, with the result that nothing but Lucanids were brought in, including *Eurytrachelus titanus,* Boisd., and *Aegus* (*Odontolabis*) *acuminatus,* F. As these large beetles feed on plant-juices, the possible damage in a coconut plantation is considerable, for they have been observed to gnaw into the leaf stalks. The careful removal of all decaying wood in or near the plantations is suggested as a first step for the control of this pest. Considerable

numbers of *Xylotrupes gideon*, L., were also collected and were stated by the coolies to have all been caught on the leaves. Larvae of *Brachartona catoxantha* were only found here and there.

The Pyralid, *Melissoblaptes rufovenalis*, was found in great numbers on the same plantation, which is in another district from that in which the author first met with it. In a Hevea plantation, *Pulvinaria* (*Lecanium*) *psidii* was found; this is an addition to the list of the pests of *Hevea* in Java.

CORNWALL (J. W.). *Lepisma saccharina* (?); its **Life-History and Anatomy and its Gregarine Parasites.**—*Ind. Jl. Med. Research, Calcutta*, iii, no. 1, July 1915, pp. 116–131, 5 plates.

Lepisma saccharina (silver fish) in the Madras Presidency seems to thrive better in the hills than in the plains. Its ravages amongst unprotected books, papers, etc., are sufficient to make measures of extermination advisable. The female deposits from 6 to 10 eggs at a time in sheltered crevices. Hatching takes place in 45 to 66 days at 65°–68° F. The young insect resembles the adult in its main characteristics. Maturity is reached about 2 years after hatching. Feeding takes place at night. The mean duration of life without food was 88 days in insects kept under observation. A mixed diet, containing proteid as well as carbohydrate, is necessary to maintain full vigour, though how proteid is obtained in the usual surroundings is not obvious. The adults do not tolerate an increase in temperature, if the air is dry. They are killed by the vapours of camphor, naphthaline, etc., in a confined space; also by crushed eucalyptus leaves, oil gas and tobacco smoke. Paper impregnated with mercuric chloride is poisonous to them; white arsenic kills very slowly, while red phosphorus has no effect. A monthly cleansing of books and papers should be sufficient to keep them from doing damage.

Two distinct species of Gregarines are parasitic in the gut of *Lepisma*, occurring either attached to the mucous membrane of the anterior part of the mid-gut, or else free in the gut cavity. When collections of the old excreta of *Lepisma* were made from undisturbed places, a number of PSOCIDAE were swept up as well, but no connection between the two insects was apparent. The PSOCIDAE were preyed on by small Arachnids, which may also prey on young *Lepisma*, but were not observed to do so.

An account of the anatomy of *L. saccharina* and its parasites is given.

DE STEFANI (T.). **Due parassiti su piante della grande coltura siciliana.** [Two pests of plants largely grown in Sicily.]—*L'Agricoltore Agrigentino, Girgenti*, vii, no. 4, April 1915, pp. 61–65, 1 fig. [Received 27th September 1915.]

A list of plants injured by *Tylenchus devastator* is given. The second pest, a Cynipid, *Aulax lini*, sp. n., causes considerable injury to the stems of flax, on which it produces a gall about the size of a small pea.

MACDOUGALL (R. S.). **Insect pests in 1914.** -*Trans. Highland & Agric. Soc. Scotland*, 1915. Reprint 27 pp., 20 figs. [Received 27th September 1915.]

Rose shoots received in July 1914 from Inverness-shire were tunnelled and killed by larvae of the Hymenopteron, *Poecilosoma candidatum.* No spray or wash is effective against this pest, but infested shoots should be cut off and destroyed and the surface soil below attacked bushes removed as a measure against the pupae. *Orchestes fagi*, L. (beech leaf-mining weevil) is very abundant, well-grown beeches being most commonly attacked. The late summer and early autumn of 1914 were characterised by the presence of enormous numbers of *Tipula.* Lawns were brown with the empty pupa cases. High and persistent gales when swarming was at its height, caused great mortality, and this probably saved many fields from oviposition. *Lepidosaphes ulmi* (apple mussel scale) and *Chionaspis salicis* (scurfy scale) were sent in more than once during the year. *Pieris brassicae* was very common in some parts; as is the case every year, the caterpillars of *Euxoa* (*Agrotis*) *segetum* (turnip moth), *Feltia* (*A.*) *exclamationis* (heart and dart moth) and *Agrotis* (*Tryphaena*) *pronuba* (yellow underwing) proved troublesome; potatoes were especially damaged by the two first named pests. The diamond back moth, *Plutella maculipennis*, appeared in overwhelming numbers, beginning early in July. The worst damage was done to turnips and swedes, entire fields being lost in some cases; cabbage also suffered. According to Mr. W. L. Johnston, the most effective method of control is stirring deeply between the drills, and when this is accompanied by damp weather the crop will not suffer to any great extent. Pears infested by the Cecidomyid, *Contarinia* (*Diplosis*) *pyrivora* (pear midge), were sent from Lanarkshire towards the end of June. The larvae of *Lygaeonematus* (*Nematus*) *erichsonii* (large larch sawfly) are sent in every summer from some part of Scotland. This insect is one of the pests scheduled by the Board of Agriculture.

Among other insects received during the year, or which proved troublesome in different parts of Scotland, were the caterpillars of the magpie moth [*Abraxas grossulariata*], gooseberry and currant sawfly [*Pteronus ribesii*] and winter moth [*Chimatobia brumata*] on gooseberries: *Melolontha hippocastani*, spruce and pine *Chermes*, the rose aphis, *Anobium domesticum* (furniture beetle), *Cryptorrhynchus lapathi* (willow and alder weevil), the maggots of the cabbage root fly [*Hylemyia antiqua*], and the three bark-boring beetles, *Hylurgus piniperda* (pine beetle), *Hylastes palliatus* (crutch beetle) and *Pityogenes bidentatus* (two-toothed pine bark beetle). The last-named is probably the commonest of the bark-borers in Scotland; it sometimes attacks spruce and larch. Inquiry was also made concerning the very troublesome house ant, *Monomorium pharaonis.*

BURGESS (A. F.) & COLLINS (C. W.). **The Calosoma beetle** (*Calosoma sycophanta*) **in New England.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 251, 27th June 1915, 40 pp., 3 figs. 7 plates, 1 map. [Received 27th September 1915.]

One living specimen of *Calosoma sycophanta* was received in New England from Europe in 1905; by the end of 1910 the numbers reached

a total of 4,046, 67 per cent. of which were liberated in the field, the balance being used for experimental work and for breeding. Practically all the beneficial results obtained in the field against the gipsy moth were secured from these. The most satisfactory method of packing the beetles for transit by post was to place single specimens in small safety-match boxes containing a quantity of wet sphagnum moss. These boxes were packed in a wooden box, usually $7\frac{1}{4}$ by 4 by $2\frac{1}{4}$ inches. Material packed in this manner arrived 10 or 12 days afterwards in good condition, provided that there was sufficient moisture; no food was necessary. Lack of moisture was the chief cause of mortality. Where transit takes 2 days or less, several beetles may be placed in a box with little risk of injury. An outdoor insectary is the best for rearing purposes. At the Gipsy Moth Laboratory at Melrose Highlands, Mass., a wooden frame was erected on a cement foundation. The exterior walls were covered with a fine-mesh wire-netting and the roof with canvas. A coating of white lead will make the canvas more durable and if the netting is painted annually with black screen paint to prevent corrosion, it will not need renewing for two or three years. Copper wire may be substituted and does not require the paint. The insectaries were provided with outside canvas curtains made to roll up in order to regulate the amount of sunlight or keep out the rain. Beetles of this genus deposit their eggs in the ground. They also conceal themselves for a part of the time beneath litter or rubbish. With *C. sycophanta* the best results have been secured by using battery jars $8\frac{1}{2}$ inches tall and $6\frac{1}{2}$ inches in diameter ; a slightly smaller size will also give satisfactory results. Circular wooden tops are used to cover these jars, a round hole being cut in the centre of each and covered with wire netting. As *C. sycophanta* is a climbing species, but is unable to make its way up the smooth sides of the jars, a narrow strip of mosquito wire is attached to the inside of the top, so that it extends into the jar and enables the beetle to climb to the top in search of caterpillars placed in the jar for food. About 3 inches of soil should be placed in each jar. For rearing small larvae of this species, jelly tumblers containing earth and covered with cheese cloth can be used. Owing to their cannibalistic habits in this stage, each larva must be kept in a separate jar if exact records are desired. Caterpillars or pupae of almost any species can be given for food and the soil must be kept slightly moist, but not wet. The larvae may also be reared in tubular wire cages, 10 inches high. The bottoms of these are circular pieces of board 4 inches in diameter, with a hole in the centre covered with netting. The tops are similar to those of the jars. These cages should be placed 8 inches in the ground. When the larvae are full grown, they pupate in the ground and cages of this type should not be disturbed until the following spring. Boxes with bottoms made of wire netting can be used as hibernating quarters for the adult beetles. They should be sunk into the ground from 18 to 20 inches, the earth inside being at the same level as on the outside. A hinged cover provided with wire netting should be placed on the top of the box. Hibernating beetles may also be kept in cylinders made of galvanised iron wire having a $\frac{1}{4}$-inch mesh. A fine mesh lining will be necessary if larvae are to be placed in them. The most satisfactory manner of rearing the beetles, if it is desired to secure definite records of the number of eggs laid by a single individual or

the amount of food consumed, is to place a pair in one of the larger glass jars with a supply of caterpillars for food. The jars should be cleaned daily and all wounded or dead beetles removed. The earth should be examined daily and when eggs are found the beetles should be transferred to another jar. The number of larvae that hatch must be taken as the index to the number of eggs deposited, since it is impracticable to remove the eggs. Records of the time spent in the larval stages or the amount of food consumed may be secured by feeding the newly-hatched larvae in individual jelly glasses. These methods of rearing beetles were followed and in 1908 and 1909 nearly 15,000 larvae were reared and colonised in the field. Since then, both beetles and larvae have been collected in the field and rearing for colonisation has been discontinued in the laboratory. Contrary to general belief, the adult beetles live two or three years and sometimes four. Among the natural enemies of this species are birds, skunks, racoons and foxes. A Tachinid fly, probably *Viviania georgiae*, and the mite, *Tyroglyphus armipes*, Bks., also attack it.

SIEGLER (E. H.) & SIMANTON (F. L.). **Life-History of the Codling Moth in Maine.**—*U.S. Dept. Agric., Washington, D.C.*, Bulletin no. 252. 10th August 1915, 50 pp., 2 plates, 9 figs. (curves), 41 statistical tables.

The results of these elaborate and laborious investigations on *Cydia pomonella* are summarised by the authors as follow :—The life-history studies of the codling moth herein recorded were conducted during the seasons of 1913 and 1914 at Winthrop, Maine. The codling moth in Maine has one full generation, a very small percentage (1 to 2 per cent.) of the individuals of which transforms to make a partial second generation. Pupation of the hibernating larvae begins about the middle of May and extends to the first part of July. The length of the spring-brood pupal stage averaged 21 days. The moths of the spring brood begin to emerge about two weeks after the petals have fallen and continue to do so for a period of about a month. The average time from the date of emergence of the moths to first oviposition was about four days. The oviposition of the spring-brood moths averaged 14 days. The average length of life of the male spring-brood moth was about 12 days ; of the female spring-brood moth about 13 days. The earliest first-brood eggs were deposited approximately three weeks after the petals dropped ; their incubation period averaged eight days, and they began to hatch in from four to five weeks after the petals had fallen. The transforming larvae of the first brood fed for a period of about 22 days. The hibernating larvae of this brood had an average feeding period of 28 days, the female larvae of the first brood feeding for a longer period than the males. The average time spent by the transforming larvae in constructing their cocoons was about six days. Approximately from 1 to 2 per cent. of the first-brood larvae transformed to first-brood pupae. The remainder of the larvae did not transform until the following spring (spring pupae). Pupation of the first or summer brood commenced during the latter part of July. The average length of the first-brood pupal stage was 15 days. The first or summer

brood of moths began to emerge just previous to mid-August and continued to issue for a period of about one month. Oviposition by moths of the first brood began about mid-August. The life-cycle of the first generation occupied 51 days. The average incubation period of the second brood of eggs was 11 days. The average feeding period of the second-brood larvae was 46 days, the female larvae feeding for a longer time than the males. The Braconid parasite, *Ascogaster carpocapsae*, Vier., was frequently reared. The well-known beetle enemy, *Tenebroides corticalis*, Melsh., was commonly found attacking the larvae. The codling moth in Maine may be controlled with one spray thoroughly applied as soon as the petals drop. Arsenate of lead, paste 2 pounds or powder 1 pound, to each 50 U.S. gallons of water is recommended.

BAKER (A. C.). **Early History and Scientific Name of the Woolly Apple Aphis.**—*Jl. Econ. Biol., London,* x, no. 3, September 1915, pp. 53–64, 1 fig.

Eriosoma lanigerum, Hausm., (woolly apple aphis) is distributed over practically the entire apple-growing regions of the world. Evidence seems to show that the pest is of American origin. This conclusion is based on the following facts:—(1) Tradition recounts the importation of the species into Europe from America; (2) the primary host is the American elm; (3) the summer generations occur in America on crab-apple, mountain ash and *Crataegus*, all of which are native trees; (4) spring migrants must be rare in Europe, judging from records of elm insects. A list of the synonyms of this species is given.

Eriosoma ulmi, L., (European elm-leaf aphis) winters on the elm, forming a curl similar to that of *E. americanum*, and migrates to *Ribes* in summer. *E. americanum*, Riley, has not been bred from the apple. *E. crataegi*, Oestlund, migrates from the elm to *Crataegus* in spring. *E. rileyi*, Thomas, forms knotty growths on the twigs and trunks of elms; the migrants are commonly observed in autumn. These seem to be the summer and autumn generations of a true elm species which migrates to other elms in the same way that *E. lanigerum* migrates to the apple.

MEYRICK (E.). **A New *Opogona* attached to Sugar-cane.**—*Entomologist's Mthly. Mag., London,* li, no. 617, October 1915, p. 291.

A description is given of *Opogona glycyphaga*, sp. n. (sugar-cane bud-moth), bred in June near Brisbane, Queensland. Species of *Opogona* are numerous in the tropics, about 70 having been recorded; the known larvae habitually feed on dry vegetable matter, such as dead leaves or refuse, in dry stems or in the interior of the nests of termites. They are liable to be accidentally introduced in the larval state.

Two Insect Pests.—*Botanical Jl., London,* iv, no. 3, October 1915, pp. 33–34.

Laburnum and lilac trees are attacked by the leaf-miners, *Leucoptera* (*Cemiostoma*) *laburnella*, Stn., and *Gracilaria syringella*, F. The eggs

of *L. laburnella* are deposited on the underside of the leaf, near the mid-rib. The larvae, after emergence, bore through the epidermis and tunnel into the tissue of the leaf. Pupation takes place on the surface of the leaf, in a cocoon. Adults emerge from July to September. The mature larvae from eggs laid by this generation descend to the base of the tree, where pupation takes place in the ground or among dead leaves, etc. The adults from this generation emerge the following spring. Young trees are especially liable to attack. *G. syringella* produces two broods annually. Eggs are laid in May and June on the leaf-stalks or on the upper surface of the leaves. The larvae emerge in about a week after oviposition and bore into the leaf tissue. In the late larval stages, feeding takes place in the rolled leaf. Pupation occurs in cocoons in crevices of the trunk or in the axils of the leaves. Adults emerge in from 10 to 14 days. The larvae of the first brood attack the apices of the leaves, those of the second the sides, base or centre. The winter is passed in the pupal stage in cocoons on the stem. Remedial measures consist of the removal of dead leaves from the base of the stem and the treatment of the stems with a caustic alkali wash.

DUPORTE (E. M.). **Experiments on the control of the bud moth.**—*Agric. Gaz. Canada, Ottawa*, ii, no. 9, September 1915, pp. 880–882.

Spraying experiments were conducted in the spring against the bud moth [*Eucosma ocellana*]; the insecticide used was lime-sulphur (concentrated home-made) diluted to [illegible], with lead arsenate paste at the rate of 5 lb. per 100 gals. The spray, which was applied as soon as the leaves were fully expanded on the 4th May, was the most effective of any single spray, only 5·8 per cent. of the insects surviving. Next in effectiveness, was the one applied 3 days before the opening of the flowers on the 12th May, while the one applied as soon as the larvae began to enter the buds on the 27th April was, contrary to the general opinion, not very effective. The effect of the fourth spray on the 3rd June, used separately, was not tried, but when combined with the one applied on 12th May, the best two-spray result was obtained, only 3·8 per cent. of the bud moths being left. Summer spraying experiments were carried out with lead arsenate in water at the rate of 3 lb. of powdered arsenate per 100 gals. Though no accurate count was kept of the number of eggs laid, a reduction of 80–85 per cent. is considered to be a conservative estimate of the result.

LOUNSBURY (C. P.). **Some Phases of the Locust Problem.**—*South African Jl. Sci., Cape Town*, xii, no. 2, September 1915, pp. 33–45.

There is reason to believe that South Africa is entering upon a cycle of years when locusts will be widespread and destructive. Within a few months, locusts have appeared in small numbers from Basutoland on the east to Namaqualand on the west, and some have been observed as far north as Francistown in Southern Rhodesia and as far south as Cradock in the Cape Province. As this has followed closely on a general drought and upon a period of freedom from locusts, it is conjectured that a new locust-cycle has begun. The important species

present in South Africa are: *Locusta pardalina* (brown locust), and *Cyrtacanthacris septemfasciata* (red locust). *Locusta danica* and *Schistocerca* (*Acridium*) *peregrina*, which also occur in S. Africa, are northern migratory forms. *L. pardalina* is an inland species, occurring on grassy plains. The Kalahari Desert seems to be the starting point of swarms, which travel in all directions, to the east to Rhodesia and the Transvaal, and to the south to the Cape and the Orange River Colony Provinces. In Natal and the Cape Province *C. septemfasciata* is essentially a coast-frequenting insect, but has also been found far inland. This species shows a preference for arboreal vegetation and this suggests that its permanent abode is not in the Kalahari Desert. The brown locust appears on the wing in March or later and deposits its eggs before winter. The eggs hatch in October and the insects become winged two months later. Two generations occur annually, the first corresponding with the spring rains, the second from 3 to 5 months later. Moisture is required for the development of the egg, which can, however, retain its vitality for more than one season. The red locust has probably only one generation annually; there is no evidence to show that eggs retain their vitality into a second season, or that rains are essential for their development. Egg-laying in Natal usually takes place early in December, and hatching follows in about 30 days. In the Cape Province, egg-laying may be prolonged into February and March. The locust problem in South Africa is associated with the occurrence of tracts of arid country where the rainfall is scanty and erratic. The gregarious, migratory locust, capable of long-sustained flight, appears to be a natural development in such a situation. The author believes that locusts are continually present in arid regions. The brown locust is supposed to be permanently resident in Kalahari, Bushmanland, Griqualand West, the eastern half of the Orange River Colony and the northern and central parts of the Cape Province. The excessive multiplication may be correlated with an abundance of food supply, which in its turn is dependent on the cyclical climatic change in the region where the insects have their permanent home.

From personal observation, the author has become impressed with the fact that locust visitations have closely followed long droughts which have been terminated by widespread and general rains. The sudden appearance of the brown locust may be explained by the fact that the eggs preserve their vitality for years in the absence of adequate moisture and accumulate in numbers during this time. Return migrations may be due to wind movements and not to inherent inclination. Birds seem to be a great factor in locust suppression in S. Africa. The most important are *Ciconia alba* and *Glareola melanoptera*, both migrants from the northern hemisphere; these arrive in October and November and depart during March. The progressive multiplication of locusts is only possible when these birds come to the country in small numbers. Other parts of Africa are subject to locust visitations, and to reach the south, the birds must traverse the continent from the north-east. If there is a shortage of locusts in one region, the birds may pass on to another where the insects are more abundant; locust cycles in one region may therefore alternate in some measure with those of another locality.

Brittin (G.). **Some New Coccidae.**—*Trans. and Proc. New Zealand Institute, Wellington*, xlvii, 12th July 1915, pp. 149-156, 9 figs. [Received 23rd October 1915.]

A description is given of the following new species of Coccidae, collected near Oamaru, New Zealand:—*Fiorinia morrisi*, on *Nothopanax* sp. and *Griselinia littoralis*; *Poliaspis argentosus*, on *Coprosoma* sp.; *Pinnaspis nitidus*, on the bark of *Pittosporum* sp. and on *Astelia*; *Lecanium armatum*, on *Muehlenbeckia australis*; *Pseudococcus oamaruensis*, on roots of *Aquilegia*; *P. cockaynei*, on *Aciphylla*; *P. sexaspinus*, on the roots of sedge; *Ripersia occulta*, on roots of grass; *R. globata*, on the roots of grass, moss, and in ants' nests.

Brittin (G.). **New Coccidae.**—*Trans. and Proc. New Zealand Institute, Wellington*, xlvii, 12th July 1915, pp. 156-160, 14 figs. [Received 23rd October 1915.]

The paper contains a description of the following new Coccidae from New Zealand:—*Scutare fimbriata*, gen. et sp. n.; *Fiorinia maskelli*, sp. n.; and *Cryptococcus nudatus*, sp. n.

Watt (M. N.). **Contributions to the Study of New Zealand Entomology, from an Economical and Biological Standpoint.**—*Trans. and Proc. New Zealand Institute, Wellington*, xlvii, 12th July 1915, pp. 247–274, 19 figs. [Received 23rd October 1915.]

The eggs of *Phytometra* (*Plusia*) *chalcites*, Esp., are laid singly on the underside of the leaves of the food-plants, viz.:—*Solanum aviculare*, *S. nigrum*, dahlia, salvia, potato, tomato, and other introduced plants. Egg-laying continues throughout the summer; the incubation period varies from 7 to 29 days, according to the temperature. The larva feeds entirely on the underside of the leaves. Pupation takes place in a cocoon formed between two or more leaves a short distance from the ground. The duration of this stage was 85 days in cold weather. The larva is attacked by a Braconid parasite. The duration of the pupal stage of the parasite is about 46 days. *P. chalcites* is common between September and June in the North Island.

The eggs of *Deilemera* (*Nyctemera*) *annulata*, Boisd., are laid from September to June on the underside of the leaves of *Senecio bellidioides* (groundsel), *S. scandens*, *S. vulgaris*, *Brachyglottis repanda* (rangoria), *Erechtites argyta*, cereals, etc. It is improbable that the winter is spent in the egg-stage. Pupation takes place in a cocoon formed usually under loose bark of trees; the pupal period lasts about 18 days. This species is confined to New Zealand.

The eggs of the Geometrid, *Venusia verriculata*, Feld., are laid on the leaves of *Cordyline australis* (cabbage-tree) and *C. banksii*. The larvae are very active and congregate on the inner surface of the loose outer leaves forming the heart spike of the tree. In badly infested trees, the succulent inner heart is destroyed and quantities of coarse frass accumulate round the base of the leaves. The worst damage is done when the larvae are nearly mature. The duration of the larval stage is about 74 days. Pupation takes place within a cocoon formed in crevices of the bark or among dead leaves hanging round the stem.

The pupal stage lasts 50 days in the winter months. The enemies of *V. verriculata* include a Dipteron, which is parasitic in the larva, while *Syrphus ropalus*, Walk., and the Pentatomid bug, *Cermatulus nasalis*, prey upon the larva. This species has only been recorded from New Zealand.

Miller (D.) & Watt (M. N.). **Contributions to the Study of New Zealand Entomology, from an Economical and Biological Standpoint.**—*Trans. and Proc. New Zealand Institute, Wellington*, xlvii, 12th July 1915, pp. 274–284, 16 figs., 2 plates. [Received 23rd October 1915.]

The larva of the Tachinid, *Phorocera nefaria*, Hutton, is an internal parasite of the larva and pupa of the Geometrid, *Venusia verriculata*. The method by which the host becomes infested is unknown. The larva, when mature, emerges from the pupa of the host, and pupates, being protected by the cocoon spun by the host just prior to its final moult. In the specimen described the pupal stage lasted from 10th August till 1st October. This species has also been reared from the pupa of the Psychid, *Liothula* (*Oeceticus*) *omnivora*, and it seems probable that other Lepidopterous larvae are attacked.

The larva of *Syrphus ropalus*, Walk., destroys those of *Venusia verriculata* (cabbage-tree maggot). The larval stage probably lasts several months. In captivity the larvae of *Tortrix postvittana* were also attacked. The pupa is usually found near the base of the leaves, on the underside. The duration of this stage is about 3 weeks.

The eggs of *Phytomyza albiceps*, Mg., are deposited in pockets of the cuticle of the outer margin of the leaf of the host plant. The larva hatches on the 6th day and at once proceeds to burrow into the leaf. The larval period lasts 9 days, pupation taking place within the substance of the leaf. This fly is attacked by two Hymenopterous parasites belonging to the genus *Chrysocharis*, the smaller of which may be a hyperparasite of the larger. The food-plants of this species are *Sonchus asper* (sowthistle), *S. oleraceus*, *S. arvensis*, *Taraxacum officinale* (dandelion), etc. It has been recorded in New Zealand from October to April.

Beeson (C. F. C.). **Forest Entomology.** Reprint from *Ann. Rept.——Bd. Scientific. Advice for India, 1913–1914, Calcutta*, 1915. Economic Zoology, pp. 8–11.

Insect pests of the sál (*Shorea robusta*) included the Longicorns, *Æolesthes holosericea* and *Hoplocerambyx spinicornis*; these species were observed in Bengal and the United Provinces. Their appearance is identical in the larval stages, and their feeding habits are similar, but *H. spinicornis* is probably the more dangerous pest. It was intended to attempt the control of the Scolytid, *Diapus furtivus*, Samps., in 1914. The *sál*-seedling moth-borer, *Pammene theristis*, Meyr., has been found throughout the United Provinces and appears to be responsible for the death of 30 per cent. of the seedlings annually. The following Scolytids were found to be common *sál* borers in Bengal and the United Provinces, some of them being recorded from India for the first time :—*Xyleborus andrewesi*, Bldfd. ; *X. laticollis*, Bldfd. ; *X. parvulus*, Eichh. ; *X. perforans*, Woll. ; *X. semigranosus*, Bldfd. ;

X. submarginatus, Bldfd.; *Diapus furtivus*, Samps.; *D. quinquespinatus*, Chap.; *Platypus curtus*, Chap., and *P. solidus*, Chap A general outbreak of the Noctuid, *Paectes* (*Ingura*) *subapicalis*, Walk., occurred in the *sál* areas of the Central and United Provinces. In the Mandla division, *sál* saplings were attacked by the bark-eating caterpillar, *Arbela tetraonis*, Moore.

As regards insects attacking teak (*Tectona grandis*), an enquiry into the seasonal history and distribution of *Duomitus ceramicus*, Walk. (bee-hole borer of teak) was commenced in Burma during the year; the existing account of the life-cycle of this species is not applicable throughout Burma. Similar cavities in the heartwood are produced in poles and saplings by two Hepialid moths—one of which is allied to *Phassus malabaricus*—three Longicorns and one Chrysomelid beetle, a species of *Sagra*. *Xyleborus fraternus*, Bldfd., and *X. velatus*, Samps., are teak-boring Scolytids reported during the year and in 1912. A weevil, *Alcides* sp., was reported to be damaging young saplings.

The life-history of the Pyralid, *Hypsipyla robusta*, Moore, which attacks the toon (*Cedrela toona*), was investigated and remedies against it devised.

Ips (*Tomicus*) *longifolia*, Steb., was chiefly responsible for the bark-beetle attacks on chir (*Pinus longifolia*), though the habit appeared to be a new one, as the species had not previously been known to attack young pine growth. The scale, *Ripersia* sp., has been found to be subject to a high degree of parasitism apparently utilisable in control.

Miscellaneous pests: From the Sunderbans Division *sundri* was reported to be attacked by a Scolytid, near *Crossotarsus squamulatus*, Chapuis. In Jhansi growing shoots of *Dendrocalamus strictus* were attacked by a Trypetid fly near to *Stictaspis ceratina* and by a Bostrychid beetle, *Bostrychopsis* sp. Two Trypetids, *Chaetellipsis paradoxa*, Bezzi, and *Poecillis judicanda*, Bezzi, were bred from growing shoots of *Bambusa birmanica* in Siwalik. The Pyralid moth, *Glyphodes laticostalis*, Guen., defoliated *Holarrhena antidysenterica* in Dehra Dun. The large weevil, *Sipalus hypocrita*, Boh., was found breeding in *Bombax malabaricum* in Cochin. The Bostrychid, *Sinoxylon anale*, Les., was reported to be killing off green shisham saplings in Jhansi. The Scolytids found boring into padouk (*Pterocarpus indicus*) in the Andamans in 1912 have been identified as *Progenius laeviusculus*, Bldfd., *P. bidentatus*, Motsch., and *Xyleborus adumbratus*, Bldfd. Damage by cockchafer grubs to deodar seedlings and sál seedlings was reported. A Lasiocampid larva defoliated *Pinus khasya* in Assam. The Pentatomid bug, *Ochrophora montana*, Dist., was stated to attack the seeds of *Bambusa tulda* in Prome Division. Cossid larvae were collected by Mr. Benskin in *Boswellia serrata* and *Anogeissus latifolia* in the Central Provinces, boring into the heartwood and producing a flow of gum. This paper closes with a list of 25 publications dealing with Indian insects of economic importance.

BURKILL (T. H.). **Three Lepidoptera which attack Dioscoreas in Singapore.**—*Gardens' Bulletin, Singapore*, i, no. 9, 31st August 1915, pp. 308–310.

The Lycaenid, *Loxura atymnus*, Cram., is the most injurious pest of yams in Singapore; so far, it has only been found on *Dioscorea*

alata, L. (common yam), *D. anguina*, Roxb., and on an imported African yam. The Sphingid, *Theretra nessus*, Moore, attacks the leaves of *D. alata*, L., *D. pyrifolia*, Kunth., *D. bulbifera*, L., *D. pentaphylla*, L., and of an allied Philippine species, probably *D. cumingii*, Prain & Burkill, in preference to those of *D. aculeata*, Lamk., and *D. triphylla*, L. The Hesperid, *Tagiades gana*, Butl., feeds on the mature leaves of *D. alata* and has also been observed on *D. cirrhosa*, Lour.

Cadamustus typicus—**a minor coconut pest.**—*Gardens' Bulletin, Singapore*, i, no. 9, 31st August 1915, p. 329.

Specimens of an insect found feeding in large numbers on coconut leaves were identified by the Imperial Bureau of Entomology as the Tingid, *Cadamustus typicus*, Dist. This species was originally described from Ceylon, where it attacked cardamons and bananas, and has recently been recorded from the Philippine Islands.

Girault (A. A.). **Some New Chalcidoid Hymenoptera from North and South America.**—*Ann. Entom. Soc. America, Colombus, Ohio*, viii, no. 3, September 1915, pp. 272–278.

The following species are described :—*Pseudleptomastix squamulatus*, sp. n., from mealy bug on grapes in California ; *Eunotus americanus*, sp. n., bred from *Eriopeltis festucae* ; *Homalotylus obscurus* var. *californicus*, n., from *Chilomenes sexmaculatus* ; *Anagrus armatus*, Ashm., var. *nigriceps*, n., reared from eggs of *Empoasca rosae* in Oregon ; *Bothriothorax flaviscapus*, sp. n., from a Syrphid pupa ; *Habrocytus rosae*, Ashmead, from roses at Brooklyn, N.Y. ; *Entedononecremnus unicus*, sp. n., reared from *Aleurochiton* sp., near Georgetown, Demerara.

Girault (A. A.). **New Chalcidoid Hymenoptera.**—*Ann. Entom. Soc. America, Columbus, Ohio*, viii, no. 3, September 1915, pp. 279–284.

Among the new species described are :—*Psyllodontus secundus*, sp.n., from gall-making Psyllids in Ceylon ; *Aphidencyrtus aspidioti*, sp. n., from *Aspidiotus perniciosus* ; and *Coccidencyrtus ensifer*, Howard, from *A. juglans-regiae*.

Girault (A. A.). **New Genera of Chalcidoid Hymenoptera.**—*Jl. New York Entom. Soc., Lancaster, Pa*, xxiii, no. 3, September 1915, pp. 165–173.

Some of the types of new genera described in this paper are :—*Holanusomyia pulchripennis*, reared from *Pseudococcus citri* on bamboo at Manila ; *Epicerchysius xanthipes*, from cotton-bolls at Arlington, Texas ; *Anagyrella corvina*, from *Pseudococcus* sp. ; *Metallonoidea britannica*, reared from *Lepidosaphes ulmi* at Manchester, England ; *Pseudhomalopoda prima*, reared from *Chrysomphalus aonidum* and *Aleurocanthus woglumi* at Kingston, Jamaica ; and *Paraleurocerus bicoloripes*, reared from a cherry leaf-miner, *Lithocolletis* sp., in Massachusetts.

FELT (E. P.). **New Asian Gall Midges.**—*Jl. New York Entom. Soc., Lancaster, Pa,* xxiii, no. 3, September 1915, pp. 173–184.

The following Asiatic gall midges are described:—*Didactylomyia ceylonica*, sp. n., from Peradeniya, Ceylon; *Microperrisia pulvinariae*, sp. n., reared from *Pulvinaria* on citrus in Manila; *Dentifibula ceylonica*, sp. n., reared from twigs of *Cassia alata* infested with *Hemichionaspis* sp.; *D. obtusilobae*, sp. n., obtained from *Piper nigrum* infested with *H. aspidistrae* and a few specimens of *Aspidiotus lataniae*; this midge is probably an enemy of the first-named scale; *Diadiplosis smithi*, sp. n., reared from cocoons produced by larvae feeding on *Pulvinaria* sp. on citrus at Manila; *D. hirticornis*, sp. n., bred from mealy bugs from Japan; *Xiphodiplosis fulva*, gen. et sp. n., from *Saissetia nigra* on dahlia at Peradenyia; *Arthrocnodax rutherfordi*, sp. n., from leaves of *Melia azedarach* infested with *Tetranychus* sp.; *A. walkeriana*, sp. n., reared from *Pseudococcus* sp. on coffee; *Androdiplosis coccidivora*, gen. et sp. n., from *Aspidiotus* or *Chrysomphalus* sp. on *Limonia alata*; *Dyodiplosis generosi*, sp. n., reared from twigs infested with *Howardia biclavis* and *Aulacaspis* sp.

LEONARD (M. D.). **The Immature Stages of *Plagiognathus politus*, Uhler, and *Campylomma verbasci*, Herrich Schaeffer (Capsidae, Hemiptera).**—*Jl. New York. Entom. Soc., Lancaster, Pa.,* xxiii, no. 3, September 1915, pp. 193–196, 1 plate.

Plagiognathus politus passes the winter in the egg-stage in one-year-old apple twigs. The eggs are usually inserted singly either into the tissue of the stem at the base of the leaf-buds or into the bud scales. *Campylomma verbasci* is found throughout the summer at Rochester Junction, N.Y., breeding abundantly on *Verbascum thapsus*, L. (mullein), and on apples in nurseries. A description of the various stages is given.

MATTOON (W. R.). **Life-History of Shortleaf Pine.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 244, 21st July 1915, 46 pp., 12 figs., 10 plates, 19 tables.

Pinus echinatus, Mill. (shortleaf pine) is attacked by *Dendroctonus frontalis*, Zimm. (southern pine beetle). The larvae of this insect are active throughout the warmer portions of the year, passing through the bark to the cambium, where long tunnels are formed. The use as fuel of trees which die in autumn and early winter, serves to control this beetle. *Rhyacionia* (*Retinia*) *frustrana*, Scud. (Nantucket pine-tip moth) attacks and deforms the growing tips of the branches. The presence of dead tips and pitch exudations are the characteristic external signs of attack. As a rule this insect is not abundant for more than 1 or 2 years at a time. Owing to its quick growth, the pine usually recovers rapidly. Fallen trees become infested during the summer with the larvae of species of *Monochamus* (*Monohammus*). The eggs are laid under the bark and the larvae feed on the sapwood; the heartwood is seldom penetrated. Living trees in the southern States are never attacked. Rapid drying of the logs by exposure to sun and wind, or complete immersion in water, prevents the deposition of eggs.

COBB (N. A.). *Tylenchus similis*, **the Cause of a Root Disease of Sugar Cane and Banana.**—*Jl. Agric. Research, Washington, D.C.*, iv, no. 6, September 1915, pp. 561–568.

When investigating a disease of bananas (*Musa sapientum*) in Fiji in 1890–91, the author discovered a new species of Nematode to which the name *Tylenchus similis* was given. In 1907, a Nematode infesting the roots of sugar-cane in the Hawaiian Islands, was described as *T. biformis*. These two species are now considered identical. Recently this pest of sugar-cane has been reported from Jamaica.

KOTINSKY (J.). **The Bermuda Grass** *Odonaspis*.—*Proc. Entom. Soc., Washington, Washington, D.C.*. xvii, no. 3, September 1915, pp. 101–104, 2 figs.

Odonaspis ruthae, sp. n., found in Honolulu in 1904 infesting *Cynodon dactylon* (Bermuda grass), is described. It lives underground on the stem, underneath the scale-like bracts at the nodes. Bermuda grass is the only grass suitable for lawns in Hawaii and is also well adapted for grazing, especially on low lands; this scale is therefore of economic importance. It is kept in check to a certain degree by a Chalcidoid parasite.

KEHRIG (H.). **Les dégats des microlépidoptères dans les tourteaux d'arachides.** [Damage done by Microlepidoptera in ground-nut cakes.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xiv, nos. 1–2, January-February 1915, pp. 1–2. [Received 6th October 1915.]

The ground-nut plant (*Arachis hypogaea*, L.) is one of the chief sources of wealth in the French colony of Senegal, one Bordeaux firm alone shipping 10,500 tons. The cake obtained in the process of extracting the oil is a cattle food. When stored, these cakes are attacked by a number of Microlepidoptera, the commonest species being *Ephestia elutella*. Infestation may be limited by placing near the stacks of oil cake containers filled with a fermenting bait made of 9 parts water and 1 part molasses. The moths of the first generation can be easily trapped in this manner when they emerge in spring.

NOEL (P.). **L'Attirance des mâles par les femelles.** [The attraction of male insects by the females.]—*Bull. Trim. Lab. Entom. Agric. Seine Infér., Rouen*, part. 3, July-September 1915, pp. 1–16.

The hypothesis is advanced that male insects are attracted to the females owing to the emission by the latter of special vibrations which may, perhaps, be imagined to be similar to X rays, Hertzian waves or even N rays. Experiments are described wherein the female was still attractive though hidden from view and surrounded by sulphurous and ammoniacal fumes to neutralise any characteristic odour; cases are also recorded in which the males flew down wind in search of the females used in the experiments.

KOLOSSOV (J. M.). **Матеріалы къ познанію Энтомофауны Урала.** [Materials for the study of the Insect Fauna of the Ural.]—**«Записки Уральскаго Общества Любителей Естествознанія.»** [*Bulletin de la Société Ouralienne d'Amis des Sciences Naturelles*], *Ekaterinburg*, 1915, vol. xxxv, no. 1–3, pp. 9–16.

This is a supplement to the list of the Rhynchota of the Ural Region [see this *Review*, Ser. A, iii, p. 6].

Among the species recorded are:—The Pentatomids, *Sehirus luctuosus*, M.R., and *Carpocoris purpureipennis*, De Geer; the Coreid, *Syromastes marginatus*, L.; the Lygaeid, *Nysius jacobeae*, Schill.; the Nabids, *Nabis flavomarginatus*, Schltz., and *N. ferus*, L.; and the Capsid, *Adelphocoris annulicornis*, Sahlb.

Донское бюро по борьбѣ съ вредителями сельскохозяйственныхъ растеній при Ростовскомъ на Дону Обществѣ Садоводства. [The Don Bureau for the control of pests of agricultural plants of the Rostov-on-Don Society of Horticulture.]—Supplement to **«Садоводъ.»** [*Horticulturist*], *Rostov-on-Don*, no. 9, September 1915.

A conference convened by the Rostov Society of Horticulture took place on 13th July to consider the question of the establishment of an Entomological Bureau for the province of Don. It was decided that the work of the Bureau should include investigations on the pests of horticulture and agriculture generally. The general cost of the organisation and equipment of the Bureau was estimated at £600 and the maintenance expenses at £600 a year. The Department of Agriculture is to provide the salaries of the staff of the Bureau and one half of the remaining expenses, the other half being borne by the local authority for the province. The Bureau will start its operations as soon as the necessary funds are assigned by the respective authorities. The regulations proposed for the Bureau were approved by the Imperial Department of Agriculture on 8th September 1915.

VASSILIEV (J. V.). **Абрикосовая толстоножка, новый видъ насѣкомаго, вредящаго абрикосу (урюку) въ Ферганѣ, и родственная ей сливяная толстоножка.** [*Eurytoma samsonovi*, sp. n., a Hymenopteron injurious to apricots in Ferghana, and the related species, *E. amygdali*, Enderlein.]—**«Труды Бюро по Энтомологіи Учен. Комит. Глав. Управ. З. и З.»** [*Memoirs of the Bureau of Entomology of the Scientific Committee of the Central Board of Land Administration and Agriculture*], *Petrograd*, 1915, xi, no. 7, 19 pp., 9 figs.

Some genera of the CHALCIDOIDEA, such as *Torymus*, *Megastigmus*, *Syntomaspis*, *Isosoma*, *Eurytoma* and others, contain species which are phytophagous. *Eurytoma samsonovi*, sp. n., observed in Ferghana to infest apricots at 1,500 feet above sea level, is figured and described. It is related to *Eurytoma amygdali*, Enderlein [see this Review, Ser. A, ii, p. 348], and has a similar life-history. *E. samsonovi* winters as an adult larva inside fallen apricot fruits and pupates in spring, the pupal

stage lasting about 2 weeks; the imago gnaws a hole in the wall of the apricot stone and emerges. The females oviposit inside young apricot fruits, one egg being deposited in each; here the development of the larva proceeds until the middle of the summer. The infested fruits usually fall, but in some cases they remain on the tree till the larvae have matured. This pest may also breed in other stone fruits. Fallen fruits should be collected and burnt in autumn, and the trees sprayed with milk of lime while the fruits are being formed.

Борьба съ вредными насѣкомыми по лѣсничествамъ Тамбовской губерніи въ 1914 году. [The campaign against insect pests in the forests of the govt. of Tambov in 1914.]—**« Лѣсная жизнь и Хозяйство.»** [*Forest Life & Economy*], *Tambov*, no. 1, 1915, pp. 27-31.

This is a report on the work against pests carried out during 1914 in the forestries of the government of Tambov. *Lophyrus pini* and an undetermined insect [see this *Review*, Series A, ii, p. 331] infested young pines, up to 12 years old, in the Gorielsk forestry district; hand-picking was carried out and 1,351,000 of the first-named pest and 183,000 of the second were collected on the 340 acres infested; the cost of collection amounted to about 10*d.* per acre. Caterpillars of *Rhyacionia* (*Retinia*) appeared in young plantations of oak, birch and occasionally aspen. In the Usmansk forest, the shoots containing the larvae were cut off with sharp scissors, and buried in the earth from 2 to 5 feet deep. In the Pushtinsk forest *Hylobius abietis* (pine weevil) occurred over some 222 acres. In dealing with *Melolontha*, experiments in ploughing the spaces between the lines of trees were carried out; the results showed an average loss in the ploughed areas from the damage by the larvae to the roots of 10·75 per cent., against 15·37 per cent. in the unploughed areas. Several pests were found in the Borisoglichsk forest. Over 2,100 larvae of a sawfly (*Lyda* sp.) were present in each $5\frac{1}{2}$ square yards of ground in a pine plantation; some of the larvae were infested by Tachinids. The old bark was damaged, as well as the shoots of the current year. Caterpillars of *Malacosoma* (*Gastropacha*) *pini* were also present.

Jitkov (Gr.). **Работы по изученію біологіи майск. хруща и выработкѣ мѣръ борьбы съ нимъ въ 1914-мъ г. въ Фащевскомъ опытномъ лѣс—вѣ Тамбов. губер. и достигнутые въ этомъ направленіи въ указанномъ лѣс—вѣ результаты.** [Work in the Fashtchev Experimental Forest in 1914 on the study of the biology of the cockchafer and methods of controlling it, and the results obtained in the above direction in this forest.]—**« Лѣсная Жизнь и Хозяйство.»** [*Forest Life & Economy*], *Tambov*, 1915, nos. 2 and 3, pp. 21–28 and 3–17.

This is a report to the Forestry Committee of the Tambov Board of Agriculture and State Domains. During 1914, *Melolontha* were on the wing only in very small numbers, so that all the research work had to be limited to the larvae. Digging operations, accompanied by taking the temperature of each hole at the depth of about 4 inches, indicated that some connection exists between the temperature of the

soil and the level of the larvae in it. In 291 holes in the soil among pines mixed with birch and aspen, when at a depth of 4 inches, there was an average temperature of 60·4° F.; 100 per cent. of the larvae were situated at that depth; in soils with an average temperature of 59·8° F. at 4 inches, the proportion of larvae at that depth was from 80 to 99 per cent.; with an average temperature of 59° F. from 70 to 79 per cent. and 57·2° F. from 50 to 69 per cent. When the heat is considerable, the larvae do not remain near the surface of the soil. When 100 healthy larvae of the second and third stages were exposed to the sun for 20 minutes, 50 per cent. of them were killed. Further experiments are necessary to decide whether ploughing during spring and early summer, when the larvae concentrate near the surface, is a directly destructive remedy or only acts indirectly by generally improving the state of the plantations. Results in previous years have shown that the larvae prefer a fertile black soil to a sandy one. This led to experiments on the control of the larvae in sandy soil by means of trap-holes filled with black soil. Two pairs of holes of dimensions of 1 cubic metre were prepared in a pine forest on sandy soil, at the end of August 1914, one of them being filled with black soil, the other, the control, with sand; both black soil and sand had been previously cleaned and all animal and vegetable matter removed. After 4 weeks, 39 larvae were found in the holes containing black soil, and only 6 in the sand.

The total cost of this proceeding, even if done at the most favourable time, in spring and early summer, is however not much less than that of renewing the plantations.

Beeson (C. F. C.). *Ips longifolia*, **Steb., as a Pest of Chir Regeneration Areas.**—*Indian Forester, Allahabad*, xli, no. 9, September 1915, pp. 317–325.

Ips (*Tomicus*) *longifolia* was first recognised as a pest of *Pinus longifolia* (chir pine) in 1911, when it was shown to attack the mature trees. Later observations in 1913–1915 have shown that seedlings and saplings are not immune and this beetle is able to breed in trees of all ages, young pines being rapidly killed. Recent attacks suggest that the development of the bark-dwelling habit of the beetle is associated with the introduction of artificial conditions into the forest and particularly those which result from heavy fellings in the neighbourhood of advance growth. *I. longifolia* was occasionally accompanied by *Polygraphus longifolia*, Steb., *Platypus biformis*, Chap., and *Cryphalus major*, Steb., but in all instances these were secondary infestations. In all cases perfectly healthy trees were attacked and killed in from 4 to 6 weeks. Attack by one generation was sufficient to cause the death of the majority of the trees. The primary centres of infestation were situated in or near a felling area and attacks began in the May or June following felling operations. Most severe injury occurred when felling was delayed or protracted into the hot weather, or where considerable quantities of refuse were left on the felling-area after removal of the timber. From these facts, it is clear that the swarms of beetles which attacked the young growth developed in the refuse and logs of the felling-area. The winter broods of *I. longifolia* develop in trees felled in October and November, which are allowed to remain

unbarked until the next April. The emergence of the adults of the first broods occurs in late March or early April. If the material remains unbarked until the end of May, the second generation can develop. This generation attacks living trees adjoining the breeding centres. Maturity is reached in July; if the conditions are favourable, a third generation is produced, which extends the infested area. The adults of the third brood appear at the end of September and in October and either migrate or found the hibernating generation. The generations show considerable overlapping, hence there is a more or less constant emergence of adults.

The remedial measures carried out in Jaunsar indicate that the pest can be controlled, at any stage in the attack, but that it is simpler to adopt preventive measures. Methods of control are based on the principle that felling operations should be completed, and felling-areas cleared, before the beginning of April. In cases where this is impossible, the following rules should be observed:—(1) All trees felled and not removed by 1st April should be barked and the bark and small branches should be burned; (2) all trees felled during April or subsequently, and not removed within one month of felling, should be barked; (3) refuse remaining on the felling-area after April should be burned. Remedial measures should include the removal and burning of all dead, dying and freshly-attacked trees. Fresh attacks are indicated by small heaps of red bark dust in the bark crevices or at the base of the tree; the removal of a strip of bark will reveal the egg-laying adults in their galleries. The boundaries of groups of attacked trees should be accurately ascertained.

DE CHARMOY (D. D'E). **Report of the Division of Entomology.**—*Ann. Rept. Dept. Agric., Colony of Mauritius, for 1914.* [Received 18th October 1915.]

Virgin sugar-canes grown in damp localities have suffered from attack by *Sesamia vuteria* (*nonagrioides*), the pink borer; the planting of maize as a trap has given excellent results. The Chalcid, *Prophanurus* (*Ceraphron*) *beneficiens*, has been found to parasitise the eggs; this parasite has not previously been recorded in the island. As the eggs, which are laid on maize, are very conspicuous, it is easy to collect them and save those which are parasitised. The spotted borer, *Diatraea striatalis*, has been reported as seriously attacking young virgin canes at Moka; elsewhere it is limited to cane-stalks. In 1913–14, 17,500 canes were examined to determine the actual loss caused and the average infection was 21 and 12·8 per cent. and 12·6 and 13·4 per cent. at Moka and Pamplemousses respectively. The white borer, *Argyroploce schistaceana*, has spread all over the island and is very abundant in some localities. The life-history of this moth has been studied, but more data are required before control measures can be advised. In one small area, a species of *Lachnosterna* associated with *Oryctes tarandus*, caused very serious damage to full grown canes. Young plantations of mahogany trees at Mahebourg were severely attacked by a Pyralid moth. Illipe trees at "La Ferme" suffered much from a Longicorn beetle (*Philematium femorale*) and Bois noir (*Albizzia lebbek*) was again reported as having been badly affected by another Longicorn, *Batocera rubus*.

Garden pests included *Bactrocera* (*Dacus*) *ferruginea* and *Dacus* sp., which were very prevalent throughout the year. Attempts to control them by spraying the plants with lead arsenate and sugar from time to time did not seem to give any appreciable results. The cabbage moth (*Crocidolomia binotalis*); the artichoke moth (*Porpe bjerkandrella*); the fruit fly (*Ceratitis capitata*); the codling moth (*Cydia pomonella*); the Rutelid beetle, *Adoretus versutus*; *Icerya seychellarum* ("pou blanc") and many other pests were reported as causing much harm to vegetables, fruits and ornamental plants. Good results were obtained by the use of insecticides.

Among insects attacking leguminous crops, the "pois sabre" caterpillar (*Argyroploce rhynchias*) was very prevalent in different localities, causing in one instance the wholesale destruction of several fields. Its life-history has been worked out and it is possible that it may be controlled by handpicking the eggs.

A census of the area infected with *Phytalus smithi* was made as usual in May and showed that this pest had not spread further. The infestation was found to be less severe in some localities and more so in others, where many young virgin fields suffered severely. The digging out of larvae was vigorously pursued and the numbers indicated by the census tests were found to be accurate. Before the beetles began to emerge, a meeting was held, which was attended by the proprietors and managers of the sugar estates situated within the infected area, and the following agreements were made:—(1) That the estates would pay a monthly contribution of Rs. 100 for the employment of a special gang whose duty would consist of catching insects in the fields after the public have left them. A gang of thirty men was employed under the supervision of a special employé and succeeded in destroying up to the end of December 621,091 insects. (2) That estates should also employ special gangs. These gangs have captured 452,351 insects. (3) It was also agreed to cut lines through the waste lands overgrown with indigo, "herbe condé" and other shrubs in order to facilitate the capture of the beetles. Tall trees bordering certain fields were to be cut down and other small plants grown to attract the insects to definite spots, where they would be more easily destroyed. Most of these recommendations have in part been carried out and the destruction of the pest has been facilitated. (4) It was decided that beetle buyers should be selected to work under the control of the Department. They were supplied with stamped measures and were bound to use special cases and tins for storing the insects. By this means the public was fairly treated and it was ascertained that insects were not taken to non-infested localities. The number of insects destroyed in 1914 was 38,816,417; in 1913, 34,122,063 were captured. In 1914, 6,694,300 larvae were dug out from the most seriously infested fields at Maison Blanche and Mon Rocher, giving a total number of 45,510,717 insects destroyed during that year. The number of insects caught increases yearly, and more stringent measures will have to be taken against this scourge in the near future and infested estates will have to be called upon for further assistance in the campaign. Another consignment of the Scoliid wasp, *Tiphia parallela* was received from Barbados in August. A certain number of adult insects were obtained; some of them have been

liberated in the open fields and some others transferred to the insectaries. Up to the end of December no *Phytalus* larvae had been found to be parasitised.

Atkins (E. W.). **Destruction of Comb by the Wax Moth Larvae.**—*Canadian Horticulturist & Beekeeper, Peterboro, Ont.*, xxiii, no. 9, September 1915, p. 216.

The larvae of the wax moth [*Galleria mellonella*] cause serious loss to bee-keepers in Ontario. The incubation period of the eggs is from 10 to 12 days. The larvae feed on wax, pollen grains and old cocoons; the larval period lasts from 35 days to 6 weeks. Adults emerge about 2 weeks after the larvae have pupated. No parasites of the moth are known in North America. Clean, white combs are seldom attacked. For fumigating, sulphur should be used at the rate of 2 oz. for every 8 hive bodies containing frames, or carbon bisulphide, 2 oz. for 6 ten-framed hives.

Gibson (A.). **Control of Vegetable Insects.**—*Canadian Horticulturist, Peterboro, Ont.*, xxxviii. no. 9, September 1915, p. 7.

Recent experiments relating to the control of cutworms in dry areas, such as South Alberta, have shown that better results have been obtained where shorts has been substituted for bran in the poisoned bait [see this *Review*, Ser. A, iii, p. 620]. For the protection of cauliflowers and cabbages, tarred paper disks placed round the stem at the time of planting out gave satisfaction. Pyrethrum powder, 2 oz. in 1 gal. water, or white hellebore of the same strength, was used for radishes and onions, the mixture being applied once a week for 3 weeks after the plants appeared above ground.

Laffer (H. E.). **Phylloxeral Investigations.**—*Jl. Dept. Agric. South Australia, Adelaide*, xix, no. 1, August 1915, pp. 64–71, 1 fig.

In the Rutherglen district, visited by the author in April 1915, about 20,000 acres of vines have been completely destroyed by *Phylloxera*. The conditions in New South Wales are somewhat similar, and South Australia is the only important vine-growing State which so far remains free from attack. The methods of inspection of stock are excellent up to a certain point, but do not prevent the carriage of vines in personal luggage. The author is of the opinion that in order to safeguard the viticultural industry of South Australia the introduction of American vines should be allowed, in order to establish a vineyard from which stocks can be obtained immediately after an outbreak. The replanting of vineyards must keep pace with the destruction of old vines, and this will only be possible if there is a supply of new material within three years of the discovery of the pest. In Europe, where the extermination of *Phylloxera* has been attempted and failed, resistant American stocks have been successfully introduced.

Wallace (M.). Cheese Mites.—*Agric. Gazette of New South Wales, Sydney*, xxvi, pt. 8, August 2nd 1915, pp. 699–700.

The cheese mite, *Tyroglyphus siro*, multiplies quickly in cheese, bacon or flour. The mites are capable of fasting for weeks or even months in the hypopus stage until transferred to fresh food supplies by mice, flies or other agents. They rarely attack new cheese even when present in large numbers, but prefer damaged or long-stored cheese. Pressed cheeses generally escape with small damage, as the rind is too hard, but if the store be damp and warm, even these may be badly attacked. The proper finishing of the cheese is important, as loose binding or cracked rinds offer little resistance to the mite; the double-banking of matured cheese also favours the mites and incidentally damages the cheeses. The absolute removal of all mites from an infested cheese-room is practically impossible, but extreme cleanliness of all uprights, walls, floors and shelving, the removal of all broken and damaged cheeses and the systematic scrubbing of the walls and woodwork with an emulsion of soft soap and kerosene, is the best means of keeping them down. Fumigation with sulphur may be resorted to in bad cases.

Fulton (B. B.). Tree-Crickets of New York: Life-History and Bionomics.—*New York Agric. Expt. Sta., Geneva, N.Y.* Technical Bull. no. 42, May 1915, 47 pp., 21 figs., 6 plates.

The tree-crickets of New York State include seven species of the genus *Oecanthus* and one species of the genus *Neoxabea*. The time of hatching of *O. niveus*, *O. angustipennis*, *O. fasciatus* (*nigricornis*) and *O. quadripunctatus* in western New York is from 10th to 20th June. Further south, hatching is earlier. The food of the members of this genus consists both of plants and animals. In the breeding cages, the food almost entirely consisted of Aphids, while San José scale [*Aspidiotus perniciosus*] was also readily attacked. *O. fasciatus*, Fitch, appeared to feed more extensively on plant tissue. The eggs are deposited in holes in the bark of the host tree, produced by the action of the ovipositor. *O. niveus*, de Geer, is distributed generally over the United States, ranging from Massachusetts to the Pacific Coast and from Ontario in the north to Mexico in the south. It is a tree and bush-inhabiting form, found in apple orchards and occasionally in raspberry plantations, shrubberies, etc. The eggs are deposited in the inner bark of the host, or in the case of raspberry canes, in the fleshy area at the side of the bud in the leaf axil. *O. angustipennis*, Fitch, is common in the lake region of the western part of New York and on Long Island, and outside the State probably has the same range as *O. niveus*. It often accompanies the latter species in apple orchards and seems to be confined to ligneous plants, such as trees or large shrubs. The eggs are deposited in the bark of small twigs. *O. exclamationis*, Davis, has been recorded from Staten Island, New Jersey, New Haven and from parts of North Carolina and Ohio. The only known habitat on Long Island is the edge of a natural prairie, where the dominant trees are *Quercus marilandica* and *Q. macrocarpa*. *O. quadripunctatus* is common in most parts of New York State, with the exception of the northern forest areas. The

eggs are deposited in rows in the pith of *Daucus carota* (wild carrot). *O. fasciatus* is common throughout the United States. Breeding places occur in raspberry plantations, vineyards, nurseries and occasionally in orchards. Oviposition begins late in August and continues throughout September. *O. pini*, Beut., has been recorded from Massachusetts, New York and New Jersey. This species is confined to species of *Pinus*. *O. latipennis*, Riley, does not extend so far north as the other species, and in New York has only been recorded in the south-eastern portion. It attacks oak, grape-vine, cultivated flowers and shrubs. *Neoxabea bipunctata*, de Geer, which occurs in the south-eastern corner of New York, in New Jersey, Pennsylvania, Connecticut, etc., has been found on oak, willow and wild grape-vines. [See this *Review*, Ser. A, ii, p. 673.]

Parrot (P. J.). **Insects affecting Production and Grading of Fruit.**—*Proc. 60th Ann. Meeting, Western New York Hortic. Soc., Geneva, N.Y.*, 27th–29th January 1915, pp. 1–10, 7 figs.

During 1914, the rosy aphis [*Aphis sorbi*] was destructive during early summer, especially in apple orchards in counties bordering on the shore of Lake Ontario. The most effective means of controlling this pest consists of thoroughly spraying the trees when the buds are showing green but are still compact. The best spray is $\frac{3}{4}$ pt. nicotine solution (40 per cent.) in 100 gals. water, to which is added from 3 to 5 lb. dissolved soap. The pear psylla is most satisfactorily controlled by the destruction of the eggs and young larvae of the first brood while they are still on the branches, stems and fruit spurs, or on the unopened buds. Injuries to mature apples in New York may be due to one or more of the following insects :—San José scale [*Aspidiotus perniciosus*], apple fruit-fly [*Rhagoletis pomonella*], codling moth [*Cydia pomonella*], red bugs [*Heterocordylus malinus* and *Lygidea mendax*], leaf-rollers [*Archips*], tussock moth [*Hemerocampa*], etc. Red bugs are prevalent in Western New York and the Hudson River valley. The best spray against these insects is nicotine solution, 1 pt. to 100 gals. water, with the addition of from 3 to 5 lb. soap. Applications should be made before the blossoms open and after the petals have fallen. The nicotine solution, without the soap, may be added to lime-sulphur solution and lead arsenate.

The results of mixing the more common insecticides are as follows :—(1) Better results by mixing : Paris green and Bordeaux mixture ; lead arsenate and Bordeaux mixture ; tobacco with emulsions. (2) Properties unchanged : Lead arsenate (acid) and tobacco ; lead arsenate (neutral) and Bordeaux mixture or tobacco ; lime-sulphur and tobacco ; soap and tobacco or oil emulsions. (3) Efficient, non-injurious : Lead arsenate (neutral) and lime-sulphur ; soap and tobacco. (4) Inefficient, non-injurious : Lime-sulphur and soap, alkalies or acids. (5) Dangerous : Paris green and lime-sulphur, soap or oil emulsions ; lead arsenate (acid) with soap or emulsions of alkalies ; emulsions and lime-sulphur ; zinc arsenite with lime-sulphur, soap or emulsions ; sulphides of soda or potash with arsenicals.

SOMES (M. P.). **The Acridiidae of Minnesota.**—*University of Minnesota, Agric. Expt. Sta., University Farm, St. Paul,* Technical Bull. 141, July 1914, 100 pp., 4 plates, 11 figs.

This is an account of the ACRIDIIDAE found in Minnesota with keys to the genera and species; notes and illustrations of the habitat of many species and maps showing their distributon are added.

SCARIOLI (D. G.). **Gli Afidi** [Aphids]. -*Venezia Agricola, Venice,* xviii, no. 32, 8th August 1915, p. 3. [Received 11th October 1915.]

Experiments made by Perrusino of Turin in injecting potassium cyanide into plants with the object of poisoning them and rendering them objectionable to Aphids, failed entirely, the cyanide being decomposed by the plant juices. Some damage was done to the plants at the points of injection and the Aphids only moved away from this part to others; in some cases the plants were seriously damaged. Phenicated tobacco extract, 1 part in 500 of water, sprayed over the plants soon after dawn is stated to be effective against Aphids; a little carbonate of soda, added to the mixture to neutralise any excess of sulphuric acid present and to decompose in part the nicotine sulphate, renders the spray more active. It should always be prepared just before use and not kept in stock ready mixed.

Il Piretro Insetticida. [Pyrethrum as an Insecticide.]—*Rivista di Agricoltura, Parma,* xxi, no. 42, 15th October 1915, pp. 660-662.

Dr. G. Tropea has published in the "Bollettino di studi ed informazioni del R. Giardino Coloniale di Palermo" a detailed account of the cultivation of pyrethrum for use as an insecticide. The plant requires a temperate climate rather warm and dry; if cultivated in a damp locality, the plant thrives, but the active principle on which its value as an insecticide depends is very slightly developed. It grows well on a dry and stony, calcareous soil and is propagated by seed, of which, even in good samples, 20 per cent. fail to germinate. In places where the winter is not severe, it may be sown in September; otherwise it is best to wait until March; in a few months plants 4 or 5 inches high will be obtained and these will produce a few flowers. These should be planted out in the following spring, about a foot apart. Flowering begins in the second half of May, or later, if the spring be cold and wet, and lasts for two months; the plants do not all flower at the same time. The flowers are collected by women and children, when they are on the point of opening, as these give a powder of higher insecticidal value than those which are fully opened. When the harvest is over, the plants are cut down and the soil between the rows well dug. Cultivation may go on for from 6 to 8 years on the same land, which must then be ploughed up and used for other crops. Each plant, if well grown, will yield an average of 100 flower-heads or about a ton to the acre when fresh, or 5 cwt. when dried. The flower heads are spread on sheets in a layer 1 to $1\frac{1}{2}$ inches thick and turned 2 or 3 times a day; they are then ground up. The fresh powder is quite inert and requires to ferment slowly for 2 or 3 months before it becomes active, and should then be kept in hermetically closed

vessels or it will lose all insecticidal property. It was long supposed that pyrethrum of any insecticidal value could only be grown in Dalmatia, and the people of that country encouraged this idea in order to protect their own industry. The cause of the failure of the early attempts to grow it elsewhere was the use of too good a soil and too much manure and water; really good pyrethrum can only be grown in a poor, stony, limestone soil in which hardly anything else will thrive.

BURGST (C.A.L. Smits van). **A Minute Hymenopteron** *Aspidiotiphagus schoeversi*, **sp. n.**—*Tijdschrift v. Entomologie d. Nederl. Entom. Ver., s'Gravenhage*, lviii, 1915, pp. 292–295, 1 plate. [Received 11th October 1915.]

Sixteen individuals of this new parasitic Chalcid were bred from males of *Hemichionaspis* (*Chionaspis*) *aspidistrae*, on *Aspidistra* in a greenhouse at Gouda in Holland.

BALLOU (H. A.). **West Indian Wasps.**—*Agric. News, Barbados*, xiv, no. 349, 11th September 1915, p. 298, 4 figs.

Polistes crinitus (Jack Spaniard) is abundant in most of the Windward and Leeward Islands, but is rare in Barbados, where *P. annularis* (wild bee) occurs. The latter occurs also in St. Vincent and has been introduced into Montserrat. *P. bellicosus* (cow bee) occurs in Barbados. *Polybia occidentalis* (maribunta) is the common wasp in Grenada; while in the Virgin Islands, a wasp which very much resembles it in size and general appearance is *Megacanthopus indeterminabilis*. The three species of *Polistes* are well-known enemies of many other insects. In St. Vincent, *P. annularis* controlled the cotton worm [*Alabama argillacea*] to such a degree that for some ten years the use of Paris green or other insecticide was suspended. It was introduced into Montserrat for the purpose of controlling the cotton worm, but owing to the attacks of the Pyralid moth, *Dicymolomia pegasalis*, Walk., which lives in the nests of the wasp, this introduction has only partially succeeded.

KIRK (T. W.). **Tests of spraying compounds: lime-sulphur.**—*Jl. Agric., Wellington, N.Z.*, xi, no. 2, 20th August 1915, pp. 129–134.

The susceptibility of New Zealand-grown trees to scorching by lime-sulphur is much greater than that of trees in the United States, and only the absolute necessity for a substitute for Bordeaux mixture resulted in lime-sulphur being exhaustively tested. Commercial lime-sulphur is usually of 33° Bé. strength and costs about 1s. 9d. per gallon in bulk. A home-made stock solution, which is equally effective though weaker and therefore allowing of less dilution, can be prepared according to the following formula at a considerably reduced cost:—Sulphur, 100 lb.; roche-lime (95 per cent. pure), 50 lb.; water, 50 gals. The lime is slaked with hot water; the sulphur is mixed to a paste and added with sufficient water to make up to 50 gals. This mixture is boiled vigorously, loss by evaporation being replaced. By testing the strength with a Baumé hydrometer, the proper degree of dilution is ascertainable by reference to a table which is given and which ranges from 20° to 34° Bé.

SCOTT (E. W.) & SIEGLER (E. H.). **Miscellaneous insecticide investigations.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 278, 5th October 1915, 47 pp.

Numerous experiments made with miscellaneous insecticides and spray combinations during 1912, 1913 and 1914 are described in a series of tables. Lead arsenate proved to be the most consistent and valuable stomach poison tested and was equally effective in either the paste or the powder form. Triplumbic arsenate of lead is less rapid in its effects than diplumbic arsenate, but is safer for use on tender foliage. Lead arsenate may be combined with nicotine solutions and lime-sulphur solution for the control of certain apple chewing and sucking insects, and fungus diseases. For the control of other sucking and chewing insects, lead arsenate may be combined with kerosene emulsions. Arsenate of lead, kerosene emulsion, and lime-sulphur is an incompatible mixture, owing to the formation of an insoluble calcium soap and the subsequent release of free kerosene. This result occurs in any combination containing lime-sulphur and soap. Lead arsenate should not be mixed with sodium sulphide compounds, as the soluble sodium arsenate formed is destructive to leaf tissue. Lead arsenate combined with a commercial barium tetrasulphide gave satisfactory control of the codling moth [*Cydia pomonella*] and caused no foliage injury in the experimental apple orchard. The most promising new insecticide is arsenate of calcium, which may be readily prepared as follows: Stone lime (90 per cent. CaO), 55 lb.; sodium arsenate, fused (dry, powdered) 65 per cent. As_2O_5, 100 lb.; water, 26 U.S. gals. The stone lime is placed in a wooden container and a small amount of water added, just enough to start slaking. When slaking is well under way, the sodium arsenate, which should first have been dissolved in hot water, is poured in and the mixture kept stirred until the lime has thoroughly slaked. Sufficient water should be added from time to time to prevent burning. The resulting arsenate of calcium should contain about 18 per cent. of arsenic oxide. In making this compound, it will be necessary to know approximately the calcium oxide and arsenic oxide content of the materials and to vary the formula accordingly. At the present time, arsenic acid cannot be obtained at a reasonable price and the fused (dry, powdered) sodium arsenate is recommended in the formula. While arsenate of calcium may have certain limitations, it will doubtless prove of value for the control of chewing insects on certain crops. Arsenate of iron and arsenate of zinc are not so satisfactory as lead arsenate. Arsenites are dangerous to use on tender foliage. In some instances, however, it may be possible to prevent foliage injury to some extent by combining the soluble arsenic with lime. Sodium-sulphur and potassium-sulphur compounds gave fairly satisfactory control of the San José scale [*Aspidiotus perniciosus*], in some instances equalling lime-sulphur solution. They may readily be prepared at home without the use of heat. In this bulletin, reference to any given insecticide or combination spray is rendered easy by means of a list arranged in alphabetical order.

WELDON (G. P.). **The woolly aphis as a pear pest.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* iv, no. 9, September 1915, pp. 441–444, 2 figs.

From an economic standpoint *Eriosoma lanigerum* (woolly aphis), has been associated almost entirely with the apple. Few entomologists appear to have ever found it plentiful on pear trees, and outside the States of Oregon and California it has been practically unknown on the roots of the pear. The author's attention was first directed towards the possible importance of this insect on the pear in August 1913, at Martinez, California, where it occurred abundantly on the roots of seedlings and on old trees of the Bartlett variety. Since then it has been found throughout the State. Some of the worst infested trees were in orchards from one to three years old, the smaller fibrous roots being covered with Aphids in such abundance that the sickly condition of the trees could readily be accounted for. Great numbers of Aphids were also found in two orchards at least 20 years old. On the pear, it is the fibrous roots which suffer most, and a colony of the Aphids has seldom been found where roots were of greater diameter than a lead pencil. This destruction of the fibrous roots makes this pest possibly even more dangerous to the pear than to the apple and also accounts for the fact that it has been little observed. Aerial colonies of Aphids are seldom seen on pear trees. Microscopic study has not revealed any characters by which the insects on the pear can be distinguished from those on the apple.

ESSIG (E. O.). **New Records of the shot-hole borer.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* iv, no. 9, September 1915, p. 445.

The loquat is added to the list of fruit trees attacked by *Scolytus rugulosus,* Ratz. (shot-hole borer or fruit-tree bark-beetle). In California, the new areas of infestation are gradually increasing.

Insect Notes.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* iv, no. 9, September 1915, p. 446.

The new Encyrtid parasite of mealy bugs recently imported from Sicily has been recovered from field colonies at San Diego and Pasadena. *Coccophagus orientalis,* Howard, received from Cape Town, has been colonised on the black scale at Fair Oaks. A Coccinellid, *Chilocorus bipustulatus,* from Italy has also been placed in the orchards at Fair Oaks. *Tetranychus bimaculatus* (red spider) destroyed half the crop in some fields of white and pink beans in Sacramento county. Willows heavily infested with the larvae of *Chrysobothris femorata,* F., have been received recently ; this beetle also injured a young apricot orchard. *Chionaspis pinifoliae* (pine-leaf scale) was found commonly on yellow pine in Lake County. *Pantomorus fulleri,* Horn (Fuller's rose weevil) has been doing considerable damage to lima beans in Ventura County. " Black Leaf 40 " was effective in controlling a strong infestation of *Aphis rumicis* on beans. Additional colonies of the cabbage worm parasite, *Apanteles glomeratus,* have been founded.

Maskew (F.). **Quarantine Division: Report for the Month of March 1915.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iv, no. 9, September 1915, pp. 447–448.

The following pests have been intercepted:—From Australia, *Chrysomphalus aurantii* on oranges; from the Canal Zone, *Chrysomphalus biformis* on orchids; from China, *Morganella maskelli*, *Chionaspis citri*, *Parlatoria pergandii*, *P. ziziphus*, *Aspidiotus lataniae* and *Cladosporium citri* on citrus trees; from Hawaii, *Howardia biclavis* on hibiscus; *Pseudococcus bromeliae*, *P. longispinus* and *Diaspis bromeliae* on pineapples and *Coccus longulus* on betel leaves; from Mexico, *Chrysomphalus aonidum* on green coconuts and *Lepidosaphes gloveri* on limes; from Tahiti, *Lepidosaphes beckii* on oranges and *Hemichionaspis minor* on tuberous roots; from Central America, *Saissetia hemisphaerica* on bananas; from New Zealand, *Saissetia oleae* on *Pittosporum* and *S. hemisphaerica* on camellias.

Ehrhorn (E. M.). **Report of the Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu*, xii, no. 9, September 1915, pp. 236–238.

During July, 20,002 parcels were inspected, of which 861 were fumigated and 24 burnt. *Aspidiotus destructor* was found on coconuts from Manila. For breeding beneficial insects, 31,800 pupae were used, and the parasites liberated, including *Opius humilis*, exceeded 32,123.

de Mazières (A. E.). **L'Abricotier.** [The apricot tree.]—*Rev. Hortic. de l'Algérie, Algiers*, xix, nos. 7–8, July-August 1915, pp. 105–120, 7 figs.

This paper gives information for cultivating the apricot in Algeria. Its insect enemies are few. The larva of the Buprestid, *Capnodis tenebrionis*, attacks trees already injured through some other cause and the weevil, *Rhynchites coeruleus* (*conicus*), attacks the young shoots. Collecting the adult beetles will control the first pest; jarring the trees and picking and burning all leaves curled by it should be carried out against the second. The larva of the Lepidopteron, *Enarmonia* (*Grapholitha*) *wöberiana* mines beneath the bark, which must be removed and the attacked branches tarred. The larva of *Cydia pomonella* infests the fruit and causes it to fall before maturity. Late apricots are infested by *Ceratitis capitata* and *Drosophila*. Bait-traps are advised against these two pests, which do much damage, especially on the coast.

Coste-Floret (P.). **Fabrication du Verdet neutre et du Verdet gris dans les exploitations viticoles.** [The preparation of neutral and grey acetates of copper on vine estates.]—*Progrès Agric. Vitic., Montpellier*, lxiv (32nd year), no. 39, 26th September 1915, pp. 306–308, 2 figs.

The preparation of acetate of copper on vine estates involves the storage of the wine lees, their acetification, the preparation of the copper and its oxidation, the formation of dibasic acetate, and the scraping off and drying of the copper acetate.

The cost of the product is only that of the pure metallic copper it contains, which normally amounts to 33 or 34 per cent. To obtain crystallised copper acetate or neutral acetate of copper, verdigris is treated with vinegar distilled by heat in copper boilers. The solution is then concentrated by evaporation and the crystals are allowed to settle in tanks in which wooden rods have been placed for the purpose of collecting them.

La "Diaspis" ricompare? [Is *Aulacaspis pentagona* reappearing?]—*Riv. Agricoltura, Parma,* xxi, no. 41, pp. 646–647.

Aulacaspis pentagona having apparently begun to increase, Prof. Berlese has pointed out that most of the specimens seen are males, and that all the infested branches submitted for examination are thickly covered with lichens, owing to the damp weather at the end of the past spring. The scales are able to shelter and develop under this covering, but they must ultimately expose themselves to the attacks of *Prospaltella berlesei,* so that no special action is necessary.

Schneider-Orelli (O.). **Zur diesjährigen Frostspannerbekämpfung.** [The control of *Cheimatobia brumata* in the present year.]—*Schweiz. Zeitschr. f. Obst- u. Weinbau, Frauenfeld,* xxiv, no. 19, 8th October 1915, pp. 292–294.

In 1914, the females of *Cheimatobia brumata* ascended the trees between the 21st October to 24th November, as shown by the catches on sticky bands; no males were taken after 3rd December. On this basis, sticky bands should be applied about 18th October in the present year.

Ritzema Bos (J.). **[Ziekten en beschadigingen veroorzaakt door Dieren.** [Diseases and damage caused by animals.]—*Meded. R. Hoogere Land, Tuin en Boschbouwsch., Wageningen,* viii, no. 5, 1915, pp. 301–331.

Nematodes. *Tylenchus devastatrix,* Kühn, is reported as damaging rye, oats and hyacinth bulbs; *Heterodera schachtii,* Kühn, attacked beet, oats and in one place wheat; *Aphelenchus ritzema-bosi,* Schwarz, was received from London, in the flower buds of chrysanthemums. The buds of *Lobelia cardinalis* were found to be infested by *Aphelenchus ormerodis,* Marz.; this is believed to be the first recorded case of such attack.

Black currants suffered almost everywhere from mites, *Eriophyes ribis,* Nal. At the Station two lots of 25 bushes each were treated, one with California mixture 1 part in 15 of water on 23rd April and 8th May and again on 27th May and 13th June with 1 part in 25 of water; the other was thickly dusted with very fine sulphur, but the results were unsatisfactory in both cases. It is considered far better in planting black currants to take the utmost care to obtain uninfested plants than to attempt to destroy the pest. *Heliothrips haemorrhoidalis,* Bouché, was very common in greenhouses, and in those which were heated all the year round, breeding was continuous and on the average a fresh generation occurred every month.

LEPIDOPTERA. At Zundert, great damage was done by an outbreak of *Incurvaria rubiella*, Bjerk., as was also the case in 1909 and again in 1911. The eggs are laid at the end of May or beginning of June on raspberry flowers. After an interval, which has not yet been determined, the larvae creep among the stems or drop by a thread to the ground, and collect mostly about the base of the plant, where they spin small white cocoons covered with particles of earth in which they hibernate. In March and April of the following year they leave the cocoons, again creep up the stems and begin eating into the buds, and when full grown, bore into the pith and pupate there; the pupal stage lasts about three weeks. The damage done is very serious, as the buds wither and no shoot is produced; 50 per cent. of the crop is commonly lost and it has been observed that the amount of damage steadily increases after the first two years. Spraying with lead arsenate early in March is advised, so that when the larvae begin to feed, they will find the buds poisoned; this should be repeated every ten days according to the weather. The lead arsenate will adhere better if combined with California mixture, and though this increases the cost, the sulphur acts as a further deterrent and keeps the larvae from the buds. Smearing the lower parts of the stems with soap to prevent the larvae from climbing is very useful in combination with the spraying. Larvae of *Leucoptera* (*Cemiostoma*) *laburnella*, Staint., damaged laburnum in Amsterdam, and *Gracilaria syringella*, F., attacked syringas at Zwolle and privet at Amsterdam. *Coleophora laricella*, Hb., did considerable damage to larches. The moths are on the wing in the second half of May and usually lay only one egg on a needle in which the larva, which hatches in about 10 days, at once begins to bore. In the autumn the larva attaches itself to a bud by a web and hibernates. In the following spring it creeps to the tops of the young needles and destroys them. The damage done is often very serious and there is no known method of control which is of any real value; certain insectivorous birds, especially finches, seem to exercise a certain degree of natural control. *Coleophora hemerobiella*, Scop., did very serious damage in a nursery of pear trees at Blauwkapel. As soon as the fruit began to set, the larvae bored a small hole into it, thus deforming it and greatly lowering its market value. In 1912 the varieties Doyenné du Comice and Beurré Clairgeau were specially attacked; Louise Bonne d'Avranches suffered less. Timely spraying with Paris green or lead arsenate will kill most of the pests, but in the case in question, this could not be done, as cabbages were grown under the pear trees. The owner was advised in the following winter to clear off any ragged bark from the old wood, and thus get rid of numbers of hibernating larvae, and then to spray the trees with a 10 per cent. carbolineum solution. Parsnip flowers were sent to the Station, the stalks and unripe fruits of which were gnawed and bound together with web by very active caterpillars, which were identified as *Depressaria heracleana*, de Geer; the injury greatly resembled that done to caraways by the caraway moth, *Depressaria apicella*, Hb. (*nervosa*, Haw.). The ends of the twigs of juniper bushes were damaged by *Argyresthia arceuthina*, Zell.; the moth flies in April and May, and as the larvae are full grown in spring, they would appear to hibernate in the twigs. At Tilburg, the cherry trees, especially the variety Reine Hortense, were badly attacked by *Enarmonia* (*Grapholitha*) *wöberiana*, Schiff.; this is the first case of attack on cherry

by this insect which has come under the author's notice; cleaning the bark and smearing with Leineweber's compound was advised. Canadian poplars at Oirschot suffered very severely from the attacks of *Cossus cossus*, L. (*ligniperda*, L.). Advice was given to fell the worst attacked trees and burn the stumps, and to inject benzine into the bore holes in less damaged ones and fill them with clay and then to smear the stems with Leineweber's compound. Willow twigs damaged by *Earias chlorana*, L., were received. Great damage was done to cherry and apple trees by *Cheimatobia brumata*, L., in 1913 in the Betuwe District between the Rhine and the Waal. This has been going on for several years and urgent advice was given to spray all trees and bushes and all crops grown between the trees in the orchards with Paris green and to band the trees with some sticky material. In some places the recommendations were very thoroughly carried out, with excellent results; success appears to depend very largely on the quality of the sticky material used and on the time at which the bands are put on. In the apple nurseries at Veendam a considerable number of *Polia* (*Mamestra*) *pisi*, L., occurred. The larvae feed on clover, vetches, oaks, willows and even on spruces, and may be controlled in the same manner as *Amorpha* (*Smerinthus*) *populi*, L., which was also met with in the same nurseries, by hand collection and spraying with Paris green or lead arsenate. The same methods may be used against *Euproctis* (*Porthesia*) *auriflua*, Hb., which was also found in nurseries, and against *Stilpnotia salicis*, L., which did serious damage to Canadian poplars in a nursery at Oudenbosch.

DIPTERA. At Aalsmeer a large quantity of the pupae of *Hylemyia nigrescens*, Rond., the carnation fly, were collected, and as the insect appears to be plentiful and the losses important, growers are earnestly advised to burn all infested plants. Larvae of *Merodon equestris*, F., were found both in narcissus and Amaryllis bulbs; soaking in water for a week before planting was advised. Species of *Tipula* were reported as doing serious damage, especially in meadows in the east and south and in the neighbouring parts of Belgium. The use of a very heavy roller, which was previously advised, did not give the results expected. In one locality small holes about 8 inches deep and of the same diameter, with vertical sides, were found very useful as traps, and a special tool for making these holes is now obtainable.

COLEOPTERA. Willows in various places were attacked by *Phyllodecta vitellinae*, L., and *P. vulgatissima*, L.; spraying with Paris green or lead arsenate as soon as the beetles make their appearance is advised. *Aphthona lutescens*, Gylh., which lives on *Lythrum salicaria* (loosestrife) attacked young rose grafts; the leaves of older plants were also eaten; this is apparently the first record of this insect as a pest of cultivated plants. The leaves of *Viburnum opulus nana* (dwarf guelder-rose) were eaten by *Galerucella viburni*, Payk. Garden lupins were damaged by *Sitones griseus*, F., which is constantly to be found on *Sarothamnus vulgaris* (broom). The plants may be sprayed with Paris green or lead arsenate, but when grown as green manure, this would be too costly, and before sowing land with lupins, all broom plants near it should be destroyed, as this appears to be the natural food-plant of this pest. Young spruces and firs suffered from the attacks of *Strophosomus rufipes*, Steph., which in one locality did great damage to

climbing roses, as also did *S. capitatus*, de Geer. *Dianthus* and *Gypsophylla* were damaged by *Hypera* (*Phytonomus*) *arator*, L. Strawberries were attacked by both larvae and adults of *Anthonomus rubi*, Hbst. This weevil is now much more common in Holland than formerly, though the damage done by it is not as yet important. *Rhynchites aeneovirens*, Marsh. (*minutus*, Hbst.) was also reported as attacking the flower-stalks of strawberries. Beech woods suffered seriously from *Orchestes fagi*, L., which also attacks cauliflowers, young rye and poppies, as well as apple and walnut trees. The chief damage is done by the larvae. Some injury by *O. quercus*, L., was also reported. No practical method of controlling these weevils is known. Canadian poplars were attacked by *Cryptorrhynchus lapathi*, L.; cherries by *Scolytus* (*Eccoptogaster*) *rugulosus*, Ratz., and apple twigs by *Xyleborus dispar*, F. Much damage was also done by *Amphimallus* (*Rhizotrogus*) *solstitialis*, L.

Among Hymenopterous pests, *Emphytus cinctus*, L. was found to hibernate as a larva and not as a pupa, as had been previously stated. Roses also suffered from *Ardis bipunctata*, Klug, *Eriocampoides aethiops*, F., *Hylotoma rosae*, L., *Blennocampa pusilla*, Klug, *Eriocampoides limacina*, L., *E. annulipes*, Klug, *Pteronus ribesii*, Scop. (*ventricosus*, Latr.), and *Croesus septentrionalis*, L. *Lophyrus rufus* did noticeable damage to a plantation of eight-year-old firs. *Cladius difformis*, Panz., was reported as eating the edges of the leaves of strawberries under glass. Elm leaves were mined by *Kaliosysphinga ulmi*, Sund. This pest is a more serious one in America, into which it has been imported from Europe. There is apparently only one generation in the year; the eggs are laid on the leaves and pupation takes place in the superficial layers of soil. In one nursery the numbers were so great that the plants suffered very seriously. *Cephus pygmaeus*, L., attacked wheat, and meadows were injured by *Lasius flavus*, L., and *Formica nigra*, L.; conversion to arable for several years was suggested as a remedy.

Among the Rhynchota, *Tingis rhododendri*, Horv., was found on *Kalmia latifolia* (mountain laurel); the insect hibernates in the egg stage in the tissues of the leaf, these hatch out in May; spraying with tobacco will kill the larvae, but a watch should be kept for adults and the spraying repeated to kill the larvae from eggs laid by them. Spraying in winter with from 6 to 8 per cent. carbolineum will control *Psylla pyrisuga*, Först., and the same remedy is useful against the winter eggs of *Psylla mali*, Först. A somewhat serious outbreak of *Psylla buxi*, Geoffr., was reported in box from Aalsmeer. It is not yet known whether hibernation takes place as egg or imago; the damage done is not very serious, but nevertheless merits the attention of growers. *Aphis abietina*, Walk., caused great destruction at Schoorl to *Picea alba*, *P. menziesi* and *P. pungens*; *P. excelsa* did not suffer so much. Spraying with $5\frac{1}{2}$ lb. soft soap, $2\frac{1}{4}$ lb. soda and $1\frac{1}{2}$ pints petroleum in 25 gals. of water, and also with a nicotine spray, had been carried out by the owner of the nurseries and he was advised to continue their use. These Aphids do not hibernate in the egg stage, but as wingless females, which may be found all the winter through on spruce. Multiplication appears to be parthenogenetic, as males and eggs are as yet unknown. Winged individuals occur in numbers in summer. Winter spraying with from 6 to 8 per cent. carbolineum is very effective

against this pest. Specimens of the bark of peach trees infested with males of *Phenacoccus aceris*, Sign., were received, and in the peach houses at Oosterhout all stages of this Coccid were found on 6th February; the trees were suffering seriously. Painting the attacked trees with 5 per cent. soap and 5 per cent. spirit in water was advised, and this remedy proved very satisfactory, the trees being completely cleared of the Coccids.

Bestrijding van toa-toh buiten den tabakstijd. [Control of the toa-toh moth between the tobacco seasons.]—*Meded. v. h. Deli Proefst., Medan*, ix, no. 3, 1915, pp. 83–85.

Thus far, tobacco is the only food-plant of *Phthorimaea operculella* known in Deli. The relation between the insect and tobacco is so close and the damage done by it so great, that every possible means should be used to control it during the intervals betweeen the tobacco seasons. In the second half of the year the females should be unable to find any cultivated tobacco on which to lay their eggs; there is however a certain amount of wild or native tobacco which will serve the purpose, and much of this is to be found on neglected rice-fields, this being possibly the explanation of the apparent connection between this pest and rice. During the tobacco season from February to June, there is a great surplus of food on the neglected lands, and it is therefore of prime importance to see that no wild tobacco is allowed to grow on or near the plantations, and wherever it is found growing, to uproot and burn it; burying is not sufficient. Every tobacco plantation should be gone over once in every two or three weeks and thoroughly searched, as the life-cycle of the moth from egg to imago requires about a month. The Experiment Station asks that material may be sent in for the purpose of breeding and studying parasites.

Largeau (F.). **The Coccinellid, *Cryptolaemus montrouzieri*, for the Control of Scale-Insects in the New Hebrides.**—*Mthly. Bull. Agric. Intell. & Plant Dis., Rome*, vi, no. 8, August 1915, p. 1127. [Abstract from *Rev. Agricole. Noumea*, no. 45, 1915, pp. 59–60.]

With a view to checking the several species of scales common in the coconut plantations in the New Hebrides, specimens of the Coccinellid, *Cryptolaemus montrouzieri*, have been introduced direct from Australia and have already begun the destruction of these pests. This Coccinellid is a native of New Caledonia, where it destroys the scales attacking *Araucaria*.

Savastano (L.). **La mosca delle arance e la frutticoltura meridionale.** [The Mediterranean fruit fly and fruit-growing in South Italy.] —*R. Staz. Speriment. Agrumic. Fruttic., Acireale*, Boll. no. 14, October 1914, 8 pp. [Received 26th October 1915.]

This bulletin deals briefly with the influence of *Ceratitis capitata*, Wied., on fruit-growing in South Italy. In November 1913, oranges and mandarins began to be attacked; the infestation increased in December 1913 and diminished in January 1914. From February to May, larvae were found in the oranges and mandarins both stored and

on the trees. In June, the adult flies which emerged from oranges attacked others, as well as peaches and the flower-clusters of figs; the injury to them increased in July, while apricots, figs and prickly pears were then also attacked. Damage to the last three fruits continued during August, in which month Neapolitan medlars began to be attacked. In September, the attack on peaches, figs, prickly pears and Neapolitan medlars continued, but with rapidly diminishing intensity. In October, injury to figs had practically ceased. This makes clear the means by which *C. capitata* is able to maintain its existence throughout the year.

Savastano (L.). **La mosca nera dei fichi** (*Lonchaea aristella*, **Beck.**) [The black fly of the fig, *Lonchaea aristella*, Beck.]—*R. Staz. Speriment. Agrumic. & Fruttic., Acireale*, Boll. no. 17, January 1915, 4 pp. [Received 26th October 1915.]

Lonchaea aristella, Beck., is indigenous to North Africa; Becker records it from Egypt and the Canaries, but mentions no host. Since 1912, the author has observed this Dipteron attacking figs in the province of Naples and calls it the black fig fly to distinguish it from *C. capitata*, Wied., which also attacks the fig. Oviposition takes place in August, while the figs are yet green, though about to ripen. If the fly finds the skin of the fruit pierced by another insect, it deposits its eggs in the hole already made. Hatching takes place in two or three days and the larvae work their way to the centre of the fruit. The dark green colour of the fig soon changes to a faint green, it then turns yellowish and finally assumes an ashy hue. The fruit droops and a putrescent fluid exudes. Should it remain on the branch, it withers and the larvae pupate in it. If it falls to the ground, the larvae burrow to a depth of a few millimetres and pupate there, the adult fly emerging in from 7 to 10 days. In September the second, more serious attack takes place. Besides these two aestivo-autumnal generations, there may be one in April, attacking the spring figs. *L. aristella* confines its injury to the fig, and in the province of Naples, where these observations were made, all species of fig were attacked. The fruit of the natalino variety does not all ripen in autumn, some fruits remaining over the winter and ripening in spring. It is said that larvae are able to hibernate in such fruit, but the author has not had an opportunity of verifying this. Control measures should include the destruction of this variety, which is not of real economic value. The infested flower-clusters should be destroyed in order to kill off the April generation. Infested summer figs should be destroyed so as to prevent the breeding of a second generation. Fresh figs from infested localities should not be exported. Speedy control is necessary, as this pest may adapt itself to varieties at present resistant.

Harper Gray (R. A.). **The prevention of diamond-back moth outbreaks.**—*Jl. North of England Hortic. Soc., Leeds*, nos. 53, 54, August-September 1915, pp. 197–201, 2 figs. [Received 11th October 1915.]

The outbreak of the diamond-back moth [*Plutella maculipennis*] in the summer of 1914 followed previous records in 1901, 1891, 1888,

1883, 1851 and 1837. Trials were made at Cockle Park with a view to preventing oviposition on turnips. A strongly infested turnip field was chosen and square plots, each one-twentieth of an acre in area, were marked out, and received dressings as follows:—Plot 1. Paraffin and fine sand: $1\frac{1}{2}$ pints of paraffin to 1 bushel of sand, spread by hand along the drills, over and around the turnips, at the rate of 6 cwt. per acre. Plot 2. Lime-sulphur: 1 lb. of shell-lime (slaked before boiling) and 1 lb. of sulphur boiled in 1 gal. of water for half-an-hour; this was then made up to 10 gals. with water, and applied at the rate of 40 gals. per acre by means of a knapsack sprayer. Plot 3. Paraffin and sand, as for plot 1, but at the rate of 3 cwt. per acre and broad-casted. Plot 4. Ground lime used fresh at the rate of $2\frac{1}{2}$ cwt. per acre. The above substances were applied on the afternoon of 23rd June, and on the following day, the leaves of the turnips along the rows in each plot were carefully disturbed. Practically no moths appeared in plots 1 and 4, very few in plot 3, but several in plot 2. In other parts of the field, adjacent to the plots, large numbers could be disturbed. The plots were examined for some days afterwards, when it was found that the moths were again beginning to be abundant in plots 1 and 3, whereas they were still practically absent from plot 4. No harmful results followed the dressing of ground line. When the caterpillars are on the leaves, most benefit seems to have been derived from brushing the leaves by means of a scuffler to which branches were attached, or by some modification of this method. Mr. Nichol of Adderstone Grange, Belford, adopted with much success the plan of fixing a pole in front of the scuffler, with bags hanging from the pole (preferably containing a little sand or soil mixed with paraffin) in such a way that the bags brushed four drills of turnips. By this method the leaves of each drill were brushed four times during the operation of scuffling. It was noticed by Mr. Morgan, at Cockle Park, in 1914, that turnips singled when the plants were small, suffered more from the caterpillars than when this was done with stronger and older plants. The last turnips to be singled suffered most, probably because the attack was more severe as the season advanced. Two cases are recorded in which starlings and plovers cleared the caterpillars from badly attacked fields of turnips. Near West Hartlepool, coke fires were placed round headlands of infested turnip fields and a large number of moths attracted by the light were killed.

This pest is always present, but only in specially dry seasons does it increase to the extent of becoming injurious. Parasitic enemies exercise considerable control. Out of 200 cocoons taken from a turnip field on 28th July and kept in jars, only 22 moths appeared, the remaining 178 being parasitised, the Ichneumon, *Limneria gracilis*, being one of the parasites concerned.

Golledge (C. J.). **The insects injurious to Chrysanthemums in Britain.** —*Jl. North of England Hortic. Soc., Leeds*, nos. 53–54, August-September 1915, pp. 205-216. [Received 11th October 1915.]

Red spider, *Tetranychus telarius*, L., chiefly injures the young leaves of chrysanthemums. Free use of fresh water as a spray, both in the open and under glass, is an excellent remedy against it. Fumigation

with hydrocyanic acid or painting the hot-water pipes with sulphur are useless against this pest. The leaf-miner, *Phytomyza geniculata*, Macq., is a serious pest and outbreaks of it are common. Hand-picking and burning infested leaves gives good results, but this must be properly carried out by all growers in the same locality or reinfestation is certain to occur. As a protective spray in May and June, 1 pint carbolic acid and ½ lb. soft soap in 100 gallons water may be used; if the leaves are tender, quassia should be substituted for paraffin emulsions. The only really satisfactory insecticide is tobacco extract or nicotine sulphate; eggs, larvae and pupae are killed by 1 part of nicotine in 400 parts of water. The greenhouse whitefly, *Aleurodes vaporariorum*, Westw., is a serious greenhouse pest. Plants outside also became infested and reproduction out of doors goes on until cold weather sets in, a complete generation occupying about five weeks. Fumigation with hydrocyanic acid is the most efficient control measure, but where this cannot be undertaken, repeated fumigation with tobacco may be resorted to; half a pint of fir-tree oil in 2 gallons of water makes an effective spray; special care must be taken to wet the underside of the leaves. *Saissetia hemisphaerica*, Targ., can only be controlled by spraying with water under strong pressure; soft soap and water is fairly effective against this scale, as also is a soap-paraffin emulsion made from 8 lb. soft soap and 5 gallons of paraffin boiled together in a closed vessel with 1 pint of water added when boiling; for use, 10 lb. of the jelly which results when cool, is dissolved in 40 gallons of water; all badly infested plants should be destroyed. The froghopper, *Aphrophora alni*, may be controlled by spraying with a 1 per cent. solution of tobacco extract followed by dusting the young shoots and buds with sulphur. These measures should be repeated every fortnight from March to September. The same treatment may be applied against the chrysanthemum bug, *Adelphocoris lineolatus*, Goeze. Lucerne, onions, beet and certain weeds are also food-plants of this pest. The greenhouse Orthezia (*Orthezia insignis*, Douglas) can be controlled by spraying with fir oil and water, or dipping the plant. Fumigation with hydrocyanic acid is the best remedy where practicable. Against *Enarmonia minutana*, Hb., the same treatment as for *A. lineolatus* is useful; all attacked flower buds should be picked off and destroyed; hibernating larvae may be destroyed by injecting sulphuretted hydrogen into the soil in autumn. This may also be done against *Feltia exclamationis*, L. Arsenate of lead as a fine spray will destroy the larvae; this may be made according to the following formula:—Acetate of lead, 7 oz.; pure arsenate of soda, $5\frac{1}{2}$ oz.; water, 10 gallons. The larvae of *Hepialus lupulinus*, L., often damage the underground parts of several cultivated plants besides chrysanthemums; vaporite is of some value against them and, in confined areas, injections of carbon bisulphide into the soil; pieces of potato buried a few inches below the surface serve as traps. Three species of eelworm, *Aphelenchus olesistus*, Ritz. Bos, *A. ritzemabosi*, Schwarz, and *Heterodera radicicola*, Greef., all do much harm and are very difficult to eradicate. All dead, infested plants, as well as the soil round their roots, should be at once burned. A list of insect pests of chrysanthemums in countries other than Great Britain is given and a bibliography of 18 works is appended.

ARROW (G. J.). **Upon the Beetles of the Melolonthid Genus** ***Rhopaea*** **found in the Fiji Islands..**—*Annals & Mag. Nat. History, London*, Ser. 8, xvi, October 1915, pp. 319–321.

The Melolonthid, *Rhopaea vestita*, sp. n., occurs in large numbers in the sugar-cane plantations in Viti Levu where all stages were found by Mr. R. Veitch.

BEZZI (M.). **On the Ethiopian Fruit-Flies of the Genus** *Dacus.*—*Bull. Entom. Research, London*, vi, no. 2, September 1915, pp. 85–101. 14 figs.

This paper includes a valuable key to the African species of this genus. The following species, some of which are new, are recorded :— *Tridacus lounsburyi*, Coq., from Cape Colony and German East Africa ; *T. sphaeristicus*, Speiser, from Nairobi ; *T. armatus*, F., from S. Nigeria ; *T. bivittatus*, Big., from Nigeria, Uganda, Nyasaland, etc. ; *T. momordicae*, nom. n., from the Cameroons ; *T. eburneus*, sp. n., from Uganda ; *T. xanthopterus*, sp. n., from Nyasaland ; *T. humeralis*, sp. n., from S. Nigeria ; *T. disjunctus*, sp. n., from Uganda ; *T. punctatifrons*, Karsch, from Uganda, Gold Coast, Nyasaland and Zanzibar ; *Dacus immaculatus*, Coq., from Natal ; *D. inornatus*, Bezzi, from the Congo ; *D. oleae*, Gmelin, from Cape Colony ; *D. rufus*, sp. n., from N. Rhodesia ; *D. longistylus*, Wied., occurring always on *Calotropis procera*, Mudar plant, from Egypt, the Sudan and Eritraea ; this species occurs also in South India, where it has been probably imported from Africa ; *D. brevis*, Coq., from Durban ; *D. brevistylus*, Bezzi, from British East Africa, Uganda, Nyasaland, and on citrus trees in N. Rhodesia, Zanzibar, etc. ; *D. vertebratus*, Bezzi, injurious to cultivated Cucurbitaceae, from Nyasaland, S. Nigeria and Pretoria ; *D. vertebratus* var. *marginalis*, n., from Natal and Rhodesia ; *D. ficicola*, sp. n., from Natal and N. Rhodesia, on wild fig.

THEOBALD (F. V.). **African Aphididae. Part ii.**—*Bull. Entom. Research, London*, vi, no. 2, September 1915, pp. 103–153, 38 figs.

The descriptions of African plant-lice given in this paper are based mainly on material collected from Egypt, the Transvaal, the Cape and British East Africa. *Macrosiphum pisi*, Kalt., from Nairobi, which is destructive to cultivated peas in Europe and North America, is abundant in Egypt on *Trifolium alexandrinum*. *M. sonchi*, L., in Egypt attacks *Carduus* sp. ; in Europe, the food-plants include *Sonchus oleraceus*, *Chrysanthemum segetum*, cultivated chrysanthemums, etc. *M. nigrinectria*, sp. n., from British East Africa, attacks peas. *M. hederae*, sp. n., was collected in Cape Town on *Hedera helix* (ivy). *M. rosaefolium*, sp. n., was found at Gizeh, Ghezireh and Cairo, on roses.

The following is a list of Aphids occurring on the rose from all parts of the world : *Macrosiphum rosae*, L., *M. rosaefolium*, sp. n., *M. rosaeollae*, sp. n., *M. rosaecola*, Pass., *M. solanifolii*, Ashm., *M. rosaeformis*, Das, sp. n., *Myzus rosarum*, Kalt., *M. neorosarum*, nom. n. (*rosarum*, Buckton), *M. tetrahodus*, Walk., *Aphis dirhodum*, Walk., *Hyalopterus trirhodus*, Walk., *H. dilineatus*, Buckt., and *Lachnus rosae*, Mordw. A key to the species is given.

Macrosiphoniella chrysanthemi, Del Guercio, has been recorded from British East Africa, Transvaal, England and Italy. The alate forms cluster at the tops of shoots of chrysanthemums and do considerable damage by distorting and stunting the flower buds. In England they seem to occur from September to November in the open and throughout the winter under glass. Descriptions of the following species are also given: *Rhopalosiphum carduellinum*, sp. n., from the Transvaal, on *Carduus* sp.; *R. lactucellum*, sp. n., from Egypt, on lettuce and peach; *Siphocoryne splendens*, sp. n., from Egypt, on wheat; *S. nymphaeae*, L., from Egypt, on lotus water lily, also occurring in Europe and America on *Nymphaea lutea*, *N. alba*, *Alisma plantago*, etc.; *Aphis hederella*, sp. n., from Cape Town, on *Hedera helix*; *A. pseudocardui*, sp. n., from the Transvaal, on *Carduus* sp.; *A. leguminosae*, sp. n., from Egypt and British East Africa, on beans, peas and *Gleditschia triacanthos*; *A. compositae*, sp. n., from Nairobi, on composites; *Aphis cynarae*, sp. n., from Egypt, on *Cynara* (artichoke); *A. punicella*, sp. n., from Egypt, on *Punica granatum* (pomegranate); *A. parvus*, sp. n., from Egypt, on chrysanthemums; *A. maidis*, Fitch, *A. laburni*, Kalt., *A. medicaginis*, Koch, and *Myzus tetrahodus*, Walk., from Egypt, on wheat, *Robinia* sp., *Medicago* sp., and roses respectively; *M. asclepiadis*, Pass., from Uganda, Transvaal, and Italy, on *Asclepias lunata*, *Gomphocarpus fruticosus* and *Salix* sp.; *Neotoxoptera violae*, gen et sp. n., from Transvaal, on *Viola* sp.; *Chaitophorus populi*, L., from Egypt and widely distributed in Europe, on *Populus* spp. and *Prunus* sp.; *Callipterus ononidis*, Kalt., from Egypt, Europe, North America and India, on *Trifolium alexandrinum* (berseem), *T. pratense*, *Ononis spinosus* and *Medicago sativa*; *Saltusaphis scirpus*, gen. et sp. n., from Egypt, on sedges; *Anoecia willcocksi*, sp. n., from Egypt, on the roots of wheat; *Lachnus viminalis*, Boyer, from Egypt, on willow; *Protolachnus tuberculostemmata* sp. n., from Egypt, on *Pinus* sp.; *Pemphigus globulosus*, sp. n., from Egypt, on *Populus* sp., causing large irregular galls; *Tychea phaseoli*, Pass., occurring in Egypt, Italy, France, Britain, on bean roots, *Brassica*, *Euphorbia* and *Amaranthus*; *Rhizobius graminis*, Buckt., from Egypt and Europe, on wheat and various grass roots.

New localities and food-plants are recorded: *Macrosiphum rosae*, L., from Egypt, on roses; *Rhopalosiphum dianthi*, Schrank, from Egypt, on potato, peach, and apricot, and from the Transvaal, on tobacco; *Aphis gossypii*, Glover, from Egypt, on maize; *A. tavaresi*, Del Guercio, from British East Africa on Jamaican lime; *A. rumicis*, L., from Egypt, on *Rumex* sp. and *Papaver* sp.; *A. nerii*, Boyer, from Pretoria on *Nerium oleander*; *Toxoptera graminum*, Rond., from Egypt, on wheat.

Ballou (H. A.). **Observations on insect pests in Grenada.**—*Bull. Entom. Research*, vi, no. 2, Sept. 1915, pp. 173–181.

An abstract of this report has already been published [see this *Review*, Ser. A, pp. 582–583].

Bagnall (R. S.). **A New Vine Thrips (Thysanoptera) from Cyprus.**—*Bull. Entom. Research, London*, vi, no. 2, September 1915, pp. 199–200.

A description is given of *Cryptothrips brevicollis*, sp. n., found on vines in Cyprus.

SOLOMIDES (Z. G.). **Notes on a Thrips injurious to Vines in Cyprus.**—*Bull. Entom. Research, London,* vi, no. 2, September 1915, pp. 197–199.

Cryptothrips brevicollis, Bagnall, sp. n., has been known to vine-growers in Cyprus for the past 10 years, but the actual damage caused by the insect has only recently been recognised. The disease of vines called " Caraoli " has been shown to be due to the action of this thrips. The insect has three generations annually, and between April and the middle of September attacks the tender parts of the vine. The eggs are laid in the buds or near the base of the opening leaves. The larvae on hatching injure these by cutting or scraping the epidermis and sucking the juices. The result of attack is a shortening of the nodes of the stem and the leaves become curled and spotted. The nymphs and adults continue to injure the foliage upon the branches where the attack is localised, the plants meanwhile putting out new branches. Complete destruction in one part is followed by a fresh attack elsewhere. The insect appears at the time of the opening of the leaves; eggs laid at this time hatch in from two to five days. Vines attacked early present a more injured appearance than do those attacked after the formation of the first shoots. The second generation occurs in May and June, when the flowers and young fruit are damaged. Injured fruit either remains small or dries up; in serious cases, about 50 per cent. may be completely destroyed. New flowers and small fruit may be produced in July and August, but these only serve as food for the third generation. The latter continues until the falling of the leaves, when the adults hibernate in crevices of the stem or branches or in the ground. Certain Acari are parasitic on *C. brevicollis.*

The following preventive measures are recommended:—(1) the removal of all weeds and fallen leaves; (2) the clearing of old bark from the main stem and the application of lime wash to the stems; this will kill 80 to 90 per cent. of hibernating insects; (3) deep ploughing or digging. When the crop is already affected, the vines should be sprayed when the first shoots appear with 4 lb. of quassia chips and 3 oz. of Paris green in $27\frac{1}{2}$ gals. of water. The spray should be repeated just before the flowers open.

HILL (G. F.). **Northern Territory Termitidae. Part i.**—Reprint from *Proc. Linnean Soc. N. S. Wales, Sydney,* xl, no. 1, 28th April 1915, pp. 83–113, 10 plates. [Received 20th October 1915.]

Fifteen species of Termites are dealt with in this paper, eight being new. The ten excellent plates effectively illustrate the various types of termitaria.

FROGGATT (W. W.). **A Descriptive Catalogue of the Scale Insects ("Coccidae") of Australia.**—*Agric. Gaz. of New South Wales, Sydney,* xxvi, no. 9, September 1915, pp. 754–764, 3 plates.

The list includes the following species of COCCIDAE:—*Lichtensia hakearum,* Full., on *Hakea ilicifolia*; *Asterolecanium fimbriatum,* Fonsc., recorded also from Europe and British Guiana; *A. quercicola,* Bch., on oak; *A. stypheliae,* Mask., on *Styphelia richei* and *Leptospermum* sp.; *A. centruosum,* Mask., on *Acacia* spp.; *Lecaniodiaspis*

acaciae, Mask., on *Acacia calamifolia*; *L. atherospermae*, Mask., on the bark of *Atherosperma moschata*; *L. concavus*, sp. n., on *Eucalyptus* sp.; *L. melaleucae*, Full., on *Melaleuca leucadendron*; *L. microcribraria*, sp. n., on *Epacris impressa*; and *L. newmani*, sp. n., on *Eucalyptus* sp.

White Ants in Fruit Trees.—*Agric. Gaz. of New South Wales, Sydney*, xxvi, no. 9, September 1915, p. 769.

The use of sheep dip for the purpose of killing termites is not recommended, as in some cases 50 per cent. of the contents consist of arsenic, while in others carbolic acid is present, both of which are injurious to the roots of plants. It is better to open up the soil and keep it worked round the roots and to remove all dead wood. Phosphatic or potassic manures, if dug in round the roots, should drive away the termites.

Jarvis (E.). **Experiments in the Destruction of the Cane Beetle.**—*Queensland Agric. Jl., Brisbane*, iv, no. 3, September 1915, pp. 169–170.

As a result of certain field experiments conducted during November and December 1914, acetylene light was proved to be very attractive to both sexes of adult cane beetles (*Lepidiota albohirta*); this attraction was, however, considerably influenced by various meteorological and other conditions. The movements of the beetles while flying near the light were studied in order to devise a suitable light trap. Contrivances which aim at capturing the insects by means of a shallow tray containing water and kerosene are not recommended, owing to the amount of labour involved and the frequent destruction of useful parasitic and predaceous insects. The following enemies of cane-grubs are attracted by acetylene light :—The digger wasp, *Dielis formosus*, the cockroach, *Ellipsidion pellucidus*, Brunn., and a predaceous earwig. Recent experiments with regard to the control of *Lepidiota albohirta* in the larval stage have for the most part given negative results.

Small (W.). **Annual Report of the Government Entomologist.**—*Uganda Protectorate: Ann. Rept. Dept. Agric. for the year ending 31st March 1915, Kampala*, 1915, pp. 71-77. [Received 8th October 1915.]

Among coffee pests, *Ceratitis capitata*, Wied., was not reported frequently during the year. *Stephanoderes coffeae*, Haged., is probably present on practically every coffee estate. After attacked berries had been removed from three similar lines of *Coffea arabica*, the first was sprayed with chromate of lead (3 lb. to 100 gals. of water), the second was left as a control, and the third was sprayed with arsenate of lead (3 lb. to 100 gals. of water). This was also carried out with bushes of *C. robusta* and proved more successful, though the experiments require to be continued. It will probably be advisable to spray twice during the bearing season with either of these insecticides. Coffee berries attacked by the larva of a small Lycaenid butterfly have been received from time to time. Both *Dirphya* (*Nitocris*) *princeps*, Jord. (yellow-headed coffee borer) and the Bostrychid borers, *Apate indistincta*, Murr., and *A. monacha*, F., have been again reported; the carbon bisulphide or carbon tetrachloride treatment for the former

and the benzine treatment for the latter, have been successful. The caterpillars of *Metadrepana glauca*, Hmp., and of *Parasa* sp., continued at intervals to defoliate coffee trees ; their attacks were best checked by a Paris green spray. The most commonly occurring scale-insects were : *Dactylopius* (*Pseudococcus*) *citri*, Risso, *Coccus* (*Lecanium*) *viridis*, Green, *Coccus* (L.) *africanus*, Newst., *Stictococcus gowdeyi*, Newst., *Ceroplastes ceriferus*, And., and *Selenaspidus articulatus*, Morg. Whale-oil soap and kerosene emulsion sprays were successful against these pests. Cutworms were fairly prevalent during the year. One example of a coffee root-borer was received, probably the larva of the Anthribid beetle, *Phloeobius catenatus*, Kolb. An as yet unidentified coffee-root scale-insect has been found in different parts of the country.

Among cacao pests, several reports of *Toxoptera theobromae*, Schout., were received ; it may be controlled by a whale-oil soap spray. *Adoretus hirtellus*, Castn. (cacao beetle) has done considerable damage in one or two cases. *Ceratitis punctata*, Wied. (cacao fruit fly) has not caused much damage. Cacao was attacked by *Stictococcus dimorphus*, Newst., and *Pseudococcus* sp. The former was parasitised by the Noctuid moth, *Eublemma costimacula*, Saalm. *Gryllotalpa africana*, P. de B., *Gryllus bimaculatus*, de G., and *G. gracilipes*, Sauss., were also injurious to coffee. *Helopeltis* sp. (mosquito blight) has made its appearance in Uganda.

Among rubber pests, the bee, *Trigona clypeata*, Freise, was sometimes found in the smaller branches of *Hevea* which had died back or been killed. Damage to healthy wood is not considered probable.

Among cotton pests, a small attack of the grasshopper, *Zonocerus variegatus*, L., was reported and Paris green in powder form was advised as a remedy. *Earias insulana*, Boisd. (spiny boll worm), *Leptoglossus membranaceus*, F. (leaf-footed plant bug) and the cotton-stainers, *Dysdercus nigrofasciatus*, Stål, *D. pretiosus*, Dist. *Oxycarenus hyalinipennis*, Costa, and *O. gossypinus*, Dist., were all as numerous as in previous years.

Balls (W. L.). **Notes on an Internal Disease of Cotton Seed.**—*Agricultural News, Barbados*, xiv, no. 350, 25th September 1915, p. 314.

Observations made in Egypt by the author in connection with a supply of pure strain cotton-seed showed that the diseased condition of some seed could be traced to *Oxycarenus hyalinipennis* (cotton-seed bug). The percentage of seed which failed to germinate was proportional to the duration of the time during which the cotton-seed had remained on the plant. For equal times of exposure, the severity of the damage was proportional to the abundance of *O. hyalinipennis*. The proportion of damaged seed amounted in extreme cases to 98 per cent. Examination for fungi or bacteria introduced through the punctures made by the insect failed to reveal their presence. Further tests made by exposing healthy seed to the bugs for one or two weeks showed that their salivary secretion was poisonous in some way and continued to destroy the cells after the proboscis had been withdrawn. It is therefore probable that the damage done by these insects is due rather to the poisons left behind than to the nutriment removed.

COCKERELL (T. D. A.). **Sunflower Insects.**—*Canadian Entomologist, London, Ont.*, xlvii, no. 9, September 1915, pp. 280-282.

The most serious pest of sunflowers in Colorado during 1914 was a species of *Nysius*. The bugs assembled in numbers on the flower stalks, causing the heads to wilt and die. Other insects noted were *Chloridea obsoleta*, F., on annual *Helianthus* and the perennial *H. coloradensis*, *Phytometra* (*Plusia*) *californica*, Speyer, *Caloplusia ignea*, Grote, on *H. lenticularis*, and *Syngrapha* (*Plusia*) *falcifera*, Kirby. A weevil, *Smicronyx fulvus*, Lec., was common at Boulder in 1913 and 1914; this species is probably parasitised by the Chalcids, *Callimome* sp. and *Zaglyptonotus schwarzi*, Cwfd. At Longmount, Colorado, the Gelechiid moth, *Paltodora similiella*, Chamb., is often found on *H. lenticularis*. In September 1914, a larva of the butterfly, *Charidryas gorgone*, Hb. (*Phyciodes ismeria*, Boisd.) was found on *H. argophyllus*. This species evidently hibernates as a larva.

WOODS (W. C.). *Biosteres rhagoletis*, **Richmond, sp. n., a Parasite of** *Rhagoletis pomonella*, **Walsh.**—*Canadian Entomologist, London, Ont.*, xlvii, no. 9, pp. 293-295, 1 plate.

A Braconid, *Biosteres rhagoletis*, sp. n., is described, which was bred in February and April 1914, from puparia of *Rhagoletis pomonella* (apple maggot) collected in the larval stage in Maine in August and September 1913. During 1915, the same species was reared from puparia of *R. pomonella* obtained from wild crab or cultivated apples in Orono.

BAKER (C. F.). **Notices of certain Philippine Fulgoroidea, one being of Economic Importance.**—*Philippine Jl. Sci., Manila*, x, Sec. D, no. 2, March 1915, pp. 137-144, 1 fig., 2 plates. [Received 10th October 1915.]

The fruits of *Anona muricata* in the Philippines are frequently stunted in growth and deformed owing to the attacks of the Jassid, *Hilda breviceps*, Stål, which breeds in great numbers on the very young fruits. The eggs are deposited in masses of from 10 to 100 on the surface of the fruit and surrounding leaves. They are parasitised in large numbers by a Chalcid, *Pseudobrachysticha semiaurea*, Girault. A single specimen of *H. breviceps* has been taken on *Anona reticulata*. As all the cultivated Anonaceous fruits in the Philippines were imported from America, it is probable that this insect normally feeds on the native Anonaceae of the Philippine forests. A description of the species is given.

GREEN (E. E.). **Observations on British Coccidae in 1914, with descriptions of New Species.**—*Entomologist's Mthly. Mag., London*, nos. 612 and 613, May-June 1915, pp. 175-185, 1 fig., 3 plates.

Eriococcus devoniensis, Green, occurred on wild *Erica cinerea* and on allied cultivated forms towards the end of August. *E. insignis*, Newst., and *E. greeni*, Newst., were found on grasses, usually *Agrostis* sp. *E. inermis*, sp. n., was abundant on heath in Surrey during August and September. *E. lagerstroemiae*, Kuwana, was present in a nursery

garden at St. Albans. This is a Japanese species and has probably been introduced on nursery stock. The following species are also recorded :—*Pseudococcus sphagni*, sp. n., in nests of *Formica picea* ; *P. gahani*, sp. n., on *Ribes sanguinea* ; *Cryptococcus fagi*, Baerensp., on beech trees at Camberley, associated with Hemerobiid, Psocid and Dipterous larvae ; *Fonscolomba fraxini*, Kalt., on ash and *Pulvinaria vitis*, L., on birch, lime and *Camellia*.

MOORE (W.) & RUGGLES (A. G.). **The Action of Potassium Cyanide when introduced into Tissues of a Plant.**—*Science, Philadelphia*, xlii, no. 1070, 2nd July 1915, pp. 33–36.

As a result of experiments to determine the effect of potassium cyanide on the tissues of a plant and the application of this substance to the destruction of injurious boring insects, the conclusion is reached that unless the insects can be definitely located in the tree, treatment is of little or no value. It might be locally applied where a wood-borer has been located, by drilling a hole just beneath it and introducing the potassium cyanide, or where the borer has made a large tunnel, the cyanide could be placed in this. For the majority of wood-borers, such as inhabit oaks and bore in the cambium layer, this treatment is useless, since the hydrocyanic acid does not travel in the cambium but only through the old tracheae. To be successful against sucking insects, the gas would have to pass through the vascular system or between the outer surface and the vascular system. The latter is possible in herbaceous or semi-woody plants, but would endanger their life. In woody trees, where the path of the gas is in the tracheae, there seems to be no danger to the tree, as the tracheae are already dead. Excessive amounts might however prove dangerous.

BRYCE (G.). **Rhinoceros Beetle Fungus.**—*Tropical Agriculturist, Peradeniya*, xlv, no. 3, September 1915, p. 150.

Cultures of the fungus *Metarrhizum anisopliae*, Metch., were brought to Peradeniya from the Philippines, Malay States, Hawaii and Samoa. No growth was obtained from the last two cultures, but the Philippine and Malay fungi have been established as pure cultures. Experiments on the larvae of the rhinoceros beetle [*Oryctes rhinoceros*] show that this fungus infests the young larvae, but not those which are well grown and are kept under conditions nearly approximating to their normal environment. Field experiments with this fungus in breeding traps for rhinoceros beetles are still in progress.

BROWNE (W. de C.). **A Pest of Coconuts.**—*Tropical Agriculturist, Peradeniya*, xlv, no. 3, September 1915. p. 152.

The use of kerosene emulsion against the Hispid beetle, *Brontispa frogatti*, on coconuts in the Solomon Islands has been discontinued in favour of cutting off the infested parts, thus getting rid of the pupae and eggs of the pest. After cutting, a wash of arsenate of lead in combination with Bordeaux mixture is applied. The portions removed are collected and burned. If this treatment is systematically carried out, this pest can be almost eliminated. Cutting does not appear to affect the growth of the palm.

Coffee in Ceylon.—*Tropical Agriculturist, Peradeniya*, xlv, no. 3, September 1915, p. 156.

In an extract from the Annual Report of the Manager of the Experiment Station at Peradeniya for 1914, it is stated that the Uganda coffee-bushes were attacked by the green scale [*Coccus viridis*] but became self-infected with the fungus, *Cephalosporium lecanii*, with the result that the scale was all destroyed. This is considered remarkable, as it was supposed this fungus only thrived under shade and in a damp atmosphere, whereas these bushes had no shade whatever.

RUTHERFORD (A.). **Some New Ceylon Coccidae.**—*Jl. Bombay Nat. Hist. Soc., Bombay*, xxiv, no. 1, 30th September 1915, pp. 111–118.

The following new species of COCCIDAE are described:—*Ripersia theae*, on branches of tea at Peradeniya in June 1913 and July 1914; *Coccus litseae*, from stem and branches of *Litsea longifolia*; *Neolecanium pseudoleae*, from branches of cinnamon; *Aspidiotus panici*, from the leaf-sheaths of *Panicum uncinatum* at Peradeniya; *Parlatoria zeylanica*, associated with *Chionaspis simplex*, Gr., and *Aspidiotus secretus*, Gr., on a small bamboo; *P. cinnamoni*, from the upper surface of leaves of cinnamon; *Lepidosaphes vandae*, from the stems of *Vanda spathulata*; *Leucaspis limoniae*, from leaves and petioles of *Limonia alata*; *Aulacaspis uncinati*, from beneath the leaf-sheaths of *Panicum uncinatum*.

TRAVERS (W. L.). **Locusts in North Bengal.**—*Jl. Bombay Nat. Hist. Soc., Bombay*, xxiv, no. 1, 30th September 1915, pp. 197–198.

An invasion of locusts occurred in the District of Jalpaiguri on 8th July 1915, the swarm apparently arriving from the south or south-east. Nitrogenous shade trees and green crops, including *Albizzia stipulata*, *Tephrosia candida*, etc., suffered considerable damage. Locusts have never been previously recorded in this district and their presence is remarkable considering the extremely heavy rainfall.

CHATTERJEE (N. C.). **Chemotropism, Influence of Kusum Oil on Insects.**—*Jl. Bombay Nat. Hist. Soc., Bombay*, xxiv, no. 1, 30th September 1915, pp. 198–199.

The effect of kusum (*Schleichera trijuga*) oil on the Coreid bug, *Serinetha augur*, was tested in various localities in Dehra Dun during November and December 1913. The experiments were carried out when the eggs were hatching and the larvae were passing through the different moults. It was found that the oil had a chemotropic influence on both sexes of the bug. Large numbers of males, females and nymphs were caught by sprinkling a few drops of oil on a suitable object. The nearer the oil was to the insects the larger the catch. *S. augur* is not known as a pest of crops in India, but further observations should be made to determine whether this oil has any effect on other insects of more economic importance.

De Charmoy (D. D'E.). **Report of the Division of Entomology.**—*Summary of Investigations made during the period January 1st to June 30th 1915, Dept. Agric. Mauritius, pp.* 3–7. [Received 27th October 1915.]

The life-histories of *Diatraea striatalis* (spotted borer), *Sesamia vuteria* (*nonagrioides*) (pink borer) and *Argyroploce schistaceana* (white borer) have been completely worked out and a special bulletin is being prepared. The planting of maize as a trap for *S. vuteria* continued to be successful. The evolution of the parasite, *Prophanurus* (*Ceraphron*) *beneficiens*, was found to be completed within a fortnight. The adult is ready to infect fresh moth eggs as soon as it hatches out. Eggs collected from affected maize should be placed in large glass jars. After a few days those that have turned black should be placed separately in test tubes stoppered with cotton wool and covered with a piece of muslin. When the parasites hatch out, 10 to 15 batches of eggs should be placed in each tube containing the parasites. Twelve days afterwards, a single batch of eggs is left in the test tube, the others being removed and brought to the fields in a wooden box or glass jar covered on one side with a piece of wire gauze for the liberation of the parasite. A census of the area infested by *Phytalus smithi* made in January showed a slight extension of the pest on the northern borders. A census made in May and June showed that at the Mount and Mon Rocher estates the infestation was considerably reduced when compared with that of 1914, but at Beau Plan and on small planters' lands there has been a noticeable increase. A further effort is being made to introduce its parasite, *Tiphia parallela*, from Barbados and enquiries are being made in Madagascar where two species of *Tiphia* have been reported to exist. The careful removal of all the infected fruits combined with periodical spraying with arsenate of lead considerably reduced the numbers of the curcubit flies, *Dacus curcurbitae* and *D. ferrugineus*. The insecticide was composed of: sugar, 2 lb.; glycerine, 2 oz.; arsenate of lead, 2 oz.; water, $17\frac{1}{2}$ pts. This quantity was found to be sufficient for 3,000 square feet. A test showed that 69 out of 120 fruits remained sound and reached their normal size, while 52 were attacked by the flies and dropped.

Fuller (C.). **Termite Economy.**—*South African Jl. Sci., Cape Town*, xii, no. 2, September 1915, pp. 60–64.

The conditions under which the nests of certain termites are associated with trees and shrubs, has led the author to the conclusion that the so-called "park-formation" in South Africa is entirely due to these insects. That certain termites derive some direct advantage from the presence of trees and shrubs upon their mounds is evidenced by the fact that while they do not permit grass to grow upon the mound, they do not interfere with deep rooting and stronger growing plants. The species of *Hodotermes* (harvesting termites) are well-known to injure lucerne, oat and wheat crops. The common African species, *Eutermes trinervius*, seriously reduces the feeding value of any ground it occupies and in time of drought its depredations are of great importance. Generally speaking, grass is the normal food; this is cut in the green condition and allowed to dry. The destruction of living trees is restricted to a few species and occurs only when the

natural surroundings of the nest are interfered with. The preference which all, except harvesting termites, show for dead and decaying wood is so marked that this may be said to be their favourite food. All damage to buildings is apparently done by *Termes natalensis* and *T. badius*. The destruction of young trees is caused mainly by *T. natalensis*. The view that adults or winged insects are incapable of founding a new colony is incorrect. Colonies can be experimentally established and maintained for six months under artificial conditions, and adults are able to feed and rear a number of young without themselves taking nourishment.

SWEZEY (O. H.). **Some Results of the Introduction of Beneficial Insects in the Hawaiian Islands.**—*Jl. Econ. Entom., Concord*, viii, no. 5, October 1915, pp. 450–456.

Considering its size, Hawaii has probably accomplished more in the way of combating insect pests by the introduction of their natural enemies than any other country. In 1890, Mr. Albert Koebele introduced *Novius cardinalis* to destroy the cottony cushion scale [*Icerya purchasi*]. Many of the first successful introductions—between 1893 and 1896—were Coccinellids, including *Cryptolaemus montrouzieri*, *Rhizobius ventralis* and *R. toowoombae*, which feed on mealy bugs; *Coelophora inequalis*, *Platyomus lividigaster*, *Scymnus loewii* and *S. notescens*, feeding on Aphids, and *Orcus chalybaeus* and *Chilocorus circumdatus* feeding on scale-insects. Thirty or more species of Hymenopterous parasites have been introduced, also, to prey on the above pests. Among the most valuable of the imported Coccid parasites are the Chalcids, *Encyrtus fuscus*, *Blepyrus marsdeni*, *Microterys flavus*, *Apentelicus kotinskyi*, *Adelencyrtus odonaspidis*, *Scutellista cyanea*, *Tomocera californica*, *T. ceroplastis*, *Aneristus ceroplastae*, *Coccophagus orientalis*, *C. lecanii*, *Aphelinus diaspidis* and *Aspidiotiphagus citrinus*. In 1895, among other parasites that Mr. Koebele introduced from Japan were *Chalcis obscurata* and the Braconid, *Macrodyctium omiodivorum*, which attack the pupae and caterpillars of the leaf rollers on sugar-cane and coconut palms. *C. obscurata* also parasitises the pupae of several other leaf-rollers of fruit trees and garden plants, among them *Tortrix* (*Archips*) *postvittanus* and *Amorbia emigratella*, once very abundant, but now not very injurious. *M. omiodivorum* chiefly attacks the sugar-cane leaf-roller, *Nacoleia* (*Omiodes*) *accepta*. Another phase in this natural control was the introduction of the insects which destroy lantana, by Mr. Koebele in 1902. Eight of the many species which he studied in Mexico were successfully introduced. Of these insects, the maggots of the little black seed-fly (*Agromyza* sp.) destroy the seeds in the growing berries of the lantana plant; the larvae of two moths, *Platyptilia pusillidactyla* and *Eucosma* (*Crocidosema*) *lantana*, feed in the flower clusters, thus helping to prevent the formation of the fruit; the caterpillars of the two butterflies, *Thecla echion* and *T. agra*, feed on the flowers; the larvae of the moth, *Cremastobombycia lantanella* mine the leaves; a small bug, *Teleonemia lantanae*, feeds on the underside of the leaves, causing them to die and fall off; a gall-fly, *Eutreta sparsa*, produces large swellings or galls on freshly-growing shoots, thus checking the normal growth. None of these insects have ever become injurious to any cultivated fruit or plant in Hawaii, but

they control the lantana. The most noted case of introduction of beneficial insects in Hawaii occurred in 1904–1905, when Messrs. Koebele and Perkins introduced from Australia and Fiji the egg-parasites for the sugar-cane leaf-hopper, *Perkinsiella saccharicida*. These were three Mymarids, *Paranagrus optabilis*, *P. perforator* and *Anagrus frequens*, and a Chalcid, *Ootetrastichus beatus*. Two or three years later there was comparatively little complaint of injury or loss by *P. saccharicida* and sugar-cane was again grown without the severe set-back to which young cane was always subject when the pest was at its worst, and which often resulted in ruining whole fields, in one case nearly 9,000 acres. In the year preceding the establishment of the parasites, leaf-hopper injury to cane amounted to £750,000 and the sugar industry was threatened with ruin. Of the different parasites, *P. optabilis* has been the most useful. Another remarkably successful parasite introduction was a Tachinid, *Ceromasia sphenophori*, parasitic on *Rhabdocnemis obscura* (sugar-cane weevil borer). This was brought from New Guinea by Mr. F. Muir in 1910 [see this *Review*, Ser. A, iii, p. 133]. Several species of fruit-fly parasites were brought from Africa and Australia by Dr. F. Silvestri in 1913. Some of these were reared in large numbers and widely distributed and in the following year, *Opius humilis* from Africa and *Diachasma tryoni* from Australia were found to be quite widely spread. Further introductions were made by Mr. D. T. Fullaway in 1914, but it is yet too early to expect extensive results from them.

CHILDS (L.). **Spraying Notes on the Control of the Fruit-Tree Leaf-Roller in the Hood River Valley.**—*Jl. Econ. Entom., Concord*, viii, no. 5, October 1915, pp. 450–456.

In the Hood River Valley, the presence of the apple leaf-roller [*Cacoecia argyrospila*] is not general, nor has the infestation at any time occurred to such an extent as to cause noticeable defoliation. The injury to the fruit, however, often approached 40 per cent. of the entire crop. On trees in light bearing the injury was even more severe, amounting to more than 50 per cent. In the spring of 1915, a series of experiments was made to determine the most advantageous method that could be employed under local conditions. The experimental orchard was planted with twelve-year-old Spitzenburg apples. It was found that the results were most satisfactory where lead arsenate was used at the rate of 6 lb. to 50 U.S. gals. water on 3rd April and 14th April, and also where miscible oil emulsion at the rate of 5, 6, 7 and 8 gals. per 100 gals. water was applied on 3rd April. Miscible oil is by far the more economical. For complete safety to the foliage, the oil applications should be made before the buds burst.

MELANDER (A. L.). **Varying Susceptibility of the San José Scale to Sprays.**—*Jl. Econ. Entom., Concord*, viii, no. 5, October 1915, pp. 475–481.

This investigation shows that differences in results from spraying against *Aspidiotus perniciosus*, are due to locality rather than to the strength of the solutions used. This difference cannot be wholly attributed to climate, the condition of the trees, the water used in

diluting the sprays, thoroughness of application, or apparently to any combination of extrinsic factors. The prevalence of the scale at Clarkston and its scarcity at Weenatchee, where effective spraying has kept it in complete control, further bear out the supposition that there is an inherent biological difference in the insects of the two places.

TARTAR (H. V.) & WILSON (H. F.). **The Toxic Values of the Arsenates of Lead.**—*Jl. Econ. Entom., Concord*, viii, no. 5, October 1915, pp. 481–486.

The investigations carried out for several years at the Oregon Agricultural Experiment Station to determine the relative insecticidal values of the different insecticides in common use, have shown that there are two different arsenates of lead present in the commercial material and that they are quite variable in their action and efficiency. These compounds are lead hydrogen arsenate (acid) and basic lead arsenate (neutral). The former contains approximately 33 per cent. arsenic oxide, the latter 25 per cent. *Malacosoma pluvialis*, Dyar (common tent caterpillar) proved a satisfactory subject for determining the comparative toxic value of these compounds. As soon as the sprayed foliage became dry, the caterpillars were placed on the twigs. Each morning the dead larvae were gathered, counted, and placed in glass bottles. At the conclusion of the experiments they were analysed for arsenic content. The data are tabulated in detail. Lead hydrogen arsenate acts more quickly than the basic salt and smaller amounts are required for efficiency. Although the caterpillars sprayed with the basic form lived longer, they finally died, and where not less than 2 lb. to 200 U.S. gals. was used, the damage done before they died was not serious; at certain strengths, the destructive value is lost because the caterpillars cause very serious damage before the quantity of poison eaten is large enough to kill. The lead hydrogen arsenate in strengths of 2 lb. to 50 gals. acted more quickly than the basic salt, but the results obtained with the latter were satisfactory, in that practically the same amount of foliage was eaten in both cases. In strengths of 2 to 100, the difference in action was greatly in favour of the lead hydrogen arsenate, but only a slight difference was noticed in the quantity of foliage destroyed. In strengths of 2 to 200 similar conditions were noticed, but with the basic lead arsenate the amount of foliage destroyed was increased. In strengths of 2 to 400 and 2 to 800, both materials acted more slowly and a considerable part of the foliage was eaten in the basic lead arsenate experiment. The lead hydrogen still remained satisfactory. In strengths of 2 to 1,200 neither salt prevented serious damage, and with the basic salt, the first twigs were completely defoliated and a second set partly destroyed. Further comparisons showed that the lead hydrogen arsenate, at 2 to 200 and 2 to 400, was respectively more efficient than the basic at 2 to 100 and 2 to 200. The tables show that only a few caterpillars died on the first day or two, the heaviest mortality occurring within two or three days. Some caterpillars ate only a small amount of foliage or ate slowly, and although they became sick, they managed to survive for a longer period in proportion to the amount eaten; others ate rapidly and devoured a considerable quantity of foliage before the poison could act. To ascertain the amount of arsenic in

the poisoned caterpillars, the bodies were first dried at 212° F. to get the actual weight of the dry tissue of the insects, and this was then chemically analysed. From the tables given, it appears that the arsenic content of the caterpillars poisoned with the lead hydrogen arsenate was somewhat the greater. This may be due to the higher arsenic content of the compound or to a more rapid absorbtion of this substance into the tissues.

Clausen (C. P.). **A Comparative Study of a Series of Aphid-Feeding Coccinellidae.**—*Jl. Econ. Entom., Concord*, viii, no. 5, pp. 487–491.

In order to determine the relative efficiency of some of the more important forms of Coccinellidae, a study of eight of the principal Aphid-feeding species of California was made at Sacramento during 1913, and completed at Berkeley and Riverside in 1914. The species under observation were *Hippodamia convergens*, Guér., *H. ambigua*, Lec., *Coccinella californica*, Mann., *C. trifasciata*, L., *Olla oculata*, F., *O. abdominalis*, Say, *Cycloneda sanguinea*, L., and *Adalia bipunctata*, L. Very extensive tests showed that the most satisfactory type of breeding cage was a plain three-inch vial with a cotton stopper. The stopper was covered with tissue paper to prevent the larvae from becoming entangled in the cottony fibres. No great divergence was found to exist between species as regards the length of time intervening between emergence and mating. The period of time over which oviposition extends is very largely dependent upon the conditions under which the beetles are kept. Under optimum conditions the deposition of eggs takes place daily from approximately two weeks after emergence until death. Oviposition by one female of *H. ambigua* extended over 59 days. A very considerable difference was found to exist in the number of eggs deposited by the various species; *H. convergens* deposited the greatest number and *A. bipunctata* the least. The totals of the successive stages of the life-history gave a minimum of 21 days for *O. abdominalis* and a maximum of 32·2 days for *H. ambigua*. The feeding records show that the average number of Aphids eaten by a larva during the entire period ranged from 216 for *C. sanguinea*, to 475 in the case of *C. californica*. One individual of the former species came to maturity after consuming 147 Aphids, while one larva of *C. californica* required 580, this being the maximum for a single individual. In the case of the adult beetles, the average numbers ranged from 624 Aphids for *O. oculata* to 234 for *C. sanguinea*. One adult of *O. oculata* devoured 672 Aphids. On a daily basis, the variation extended from 56·1 Aphids per individual for *H. convergens* to 15·6 for *C. sanguinea*. *C. californica* was conspicuously low in this respect when the size of this beetle is considered, the average being only 34 Aphids a day.

Wolcott (G. N.). **The Influence of Rainfall and the Non-Burning of Trash on the Abundance of *Diatraea saccharalis*. (Abstract).**—*Jl. Econ. Entom., Concord*, viii, no. 5, October 1915, pp. 496–498.

The abundance of *Diatraea saccharalis* (smaller moth borer), the most important pest of sugar-cane in the New World, depends upon two factors, rainfall and the burning of trash. Rainfall cannot be

controlled, but in many cases in Porto Rico and elsewhere trash is needlessly burned. The abundance of the pest depends in large part upon the scarcity of its cosmopolitan and omnipresent egg-parasite *Trichogramma minutum.* As the result of field-experiments in Texas and Louisiana, Mr. T. E. Holloway has conclusively shown that the burning of the cane-trash (tops and leaves) after the cane is harvested, destroys large numbers of *T. minutum* [see this *Review*, Ser. A, ii, p. 279]. In a table given in the present paper, the borer infestation in fields where the trash had been burnt is shown to be nearly 100 per cent. higher than in unburnt fields. In the discussion following this paper, Mr. O. H. Swezey pointed out that *T. minutum* has a short life-cycle and if the trash could be left for a short time, the adults would emerge.

WEISS (H. B.). *Gryllotalpa gryllotalpa*, Linn., **the European Mole Cricket in New Jersey.**—*Jl. Econ. Entom., Concord*, viii, no. 5, October 1915, pp. 500–501.

Gryllotalpa gryllotalpa, was found cutting off the roots of various plants in a nursery in Rutherford, N.Y., early in July 1915. Large quantities of imported plants are received every year at Rutherford, the majority coming from Belgium and Holland and only a small portion from France. It is almost certain that the insect came from one of the two former countries. The usual remedies are mentioned. The presence of this pest in New Jersey is an example of how impossible it is to keep out all foreign pests by a close inspection of foreign plants.

HARNED (R. W.). **The Corn-silk Beetle,** *Luperodes varicornis*, Lec., **and its Control.**—*Jl. Econ. Entom., Concord*, viii, no. 5, October 1915, pp. 507–508.

About 1st July 1915, the Chrysomelid beetle, *Luperodes varicornis*, Lec., appeared in enormous numbers in many maize fields of several counties in Mississippi. In one case, several hundred could be picked off one ear of maize. The ears have the appearance of having had the silk cut off as with a knife. As the beetles congregated only on the silk at the end of the ears, five or six feet from the ground, difficulty was at first encountered in properly applying arsenical poisons. Mr. D. L. Williams overcame this difficulty by filling an ordinary "talcum powder" can with Paris green and walking between the rows and shaking the poison directly upon the silk. One man could cover several acres a day in this way and relief was immediately obtained.

WHITMARSH (R. D.). **Some Important Insect Pests of the Greenhouse.**—*Ohio Agric. Expt. Sta., Wooster, Ohio*, Circ. no. 151, May 15th 1915, pp. 93–104, 10 figs. [Received 2nd November 1915.]

This bulletin deals with *Aleurodes vaporariorum*, *Tetranychus telarius*, *Aphis gossypii*, *Macrosiphum* (*Nectarophora*) *rosae*, *Rhopalosiphum violae*, *N. chrysanthemicoleus* and two Coccids, *Pseudococcus citri* and *P. longispinus*. A brief account of each insect is given and of the methods of control. Fumigation is of no avail against red spider and

few sprays are of any use. Nico-fume $\frac{1}{2}$ pint and lime-sulphur 2 quarts, well mixed in 25 U.S. gallons ($20\frac{3}{4}$ Impl. gals.) of water, proved satisfactory. Fumigation with Nico-fume sheets is advised against Aphids, but all marketable blooms should first be gathered. The same method is satisfactory against mealy-bugs, or spraying with Nico-fume solution and soapy water, from 2 to 4 teaspoonfuls to the gallon. Careful directions are given for fumigation with hydrocyanic acid.

THEOBALD (F. V.). **Notes on New and Little-Known British Aphides.**—*Entomologist, London*, xlviii, no. 630, November 1915, pp. 258–263.

The Aphids recorded in this paper are either new to the British list or have not been noted since the time of their description. The list includes :—*Idiopterus nephrolepidis*, Davis, taken on Polygonums in a greenhouse near London and recorded on ferns in America ; *Aphis chaerophylli*, Koch, from *Chaerophyllum tuberosum* at Hereford ; *A. apposita*, Walk., from *Senecio vulgaris* ; *A. chrysanthemi*, Koch, from *Chrysanthemum leucanthemum* and *Matricaria chamomilla* ; *A. crataegi*, Kalt., on apple at Marden, Kent, and on hawthorn at Wye, forming galls on the leaves ; *A. symphiti*, Schrank, on *Symphytum officinale* and *Anchusa italica* ; *A. callunae*, sp. n., on *Calluna vulgaris* at Brockenhurst, New Forest ; and *Macrosiphum centranthi*, sp. n., on *Centranthus rubra* and *Valeriana officinalis*.

DURRANT (J. H.). *Myelois phoenicis*, **sp. n., bred from dates in Algeria and in England.**—*Entomologist's Mthly. Mag., London*, no. 618, November 1915, pp. 305–306.

A description is given of *Myelois phoenicis*, sp. n., first met with in Algeria in 1904. This moth has been introduced into England in dates. It may become widely spread by commerce and will probably prove to be of economic importance.

BOX (H. E.). *Prionus coriarius*, **F., in Epping Forest.**—*Entomologist's Mthly. Mag., London*, no. 618, November 1915, p. 310.

Larvae of the Longicorn beetle, *Prionus coriarius*, F., were found in Epping Forest on 10th January 1915 and on subsequent occasions. Burrows were made by the larvae between the bark and the wood of an oak-log. Pupae were found in July, some in the burrows, others in the ground immediately below the log.

VINALL (H. N.). **The Field Pea as a Forage Crop.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 690, 8th October 1915, 24 pp., 16 figs.

This paper mainly deals with the cultivation of the field pea. *Bruchus* (*Laria*) *pisorum*, L., (pea weevil) is its most serious pest and in Canada has been the chief cause of limiting the acreage devoted to the pea-crop. The eggs are laid on the young pod. The larva, upon hatching, bores through the pod and enters the young seed, upon which it feeds until ready to pupate. The date of emergence of the adult varies from

harvest until planting time of the following year. If seed intended for planting is stored in tight bags and held over for a year, the adults will emerge and die before the next planting season arrives. Fumigation by means of carbon bisulphide is a more satisfactory method. *Acyrthosiphon* (*Aphis*) *pisi*, Kalt., appears in pea growing areas at intervals and may practically destroy the season's crop. Heavy rain greatly reduces the numbers of this pest.

PIPER (C. V.) & MCKEE (R.). **Bur Clover.** *U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 693, 15th October 1915, 14 pp., 7 figs., 1 table.

The most important insect enemy of bur-clover is the clover-seed Chalcid [*Bruchophagus funebris*], which also attacks red clover and lucerne. The eggs are laid in the seed-pods, within which development to the adult stage takes place. The quantity of seed thus destroyed is considerable. In California probably 10 per cent. of the early-maturing seed is destroyed, while the loss of late seed may reach 75 per cent. In the South, the loss is probably not so great. No practical method of controlling this insect is known.

MOTTAREALE (G.). *Cladosporium* **sp., in the Control of the Citrus Scale,** *Chrysomphalus dictyospermi*, **var.** *pinnulifera*, **in Calabria.** — *Atti del R. Istituto d'Incoraggiamento di Napoli, Naples*, lxvi, Ser. 6, 1915, pp. 27-31. [Abstract in Mthly. Bull. Agric. Intell. & Plant Dis., Rome, October 1915.]

Chrysomphalus dictyospermi var. *pinnulifera*, after spreading from the citrus plantations of Sicily to those in Calabria, has soon covered large areas, damaging not only the fruit, especially of bergamots, but also the green twigs and leaves. The local growers deal effectively with this scale by washing with lime-sulphur. The agricultural adviser for the province of Reggio has carried out successful experiments with hydrocyanic acid fumigation at Pellaro. In 1913, when the weather conditions allowed this scale to go on breeding even in November, its activity appeared to have diminished, as, even where the known means of control had not been applied, the plants had regained their vigour. Microscopic examination showed the presence of a species of *Cladosporium*, which was undoubtedly the cause of the death of the scales; no other fungi or bacteria were observed.

GRASSI (B.). **The Present State of our Knowledge of the Biology of the Vine** *Phylloxera*. —*Mthly. Bull. Agric. Intell. Plant Dis., Rome*, vi, no. 10, October 1915, pp. 1269-1290.

The author was charged by the Italian Ministry of Agriculture to study the biology of *Phylloxera* with a view to elucidating certain doubtful and important questions, which still remained unanswered. According to the laws of priority, the name *Phylloxera vastatrix*, Planch., should be replaced by *Phylloxera* (*Viteus*) *vitifolii*, Fitch, but the author is not inclined to adopt the change himself, owing to the long-established use of the former name. Our knowledge of the

bionomics of *Phylloxera* previous to 1905 is carefully summarised and the modification of that knowledge due to later researches form the main part of this paper.

Want of material has greatly hindered research into the fate of the newly born insects derived from the winter-egg. Material could not be obtained in continental Italy, but the nurseries of American vines at Palermo, Modica and Messina provided an abundance. The experiments made by the author with the aid of collaborators were extremely numerous, and were repeated for several years under the most varied conditions. They consisted chiefly in placing bark containing a very large number of winter-eggs, special precautions being taken to prevent their dying, in contact with uninfected European vine stocks, and also with healthy American vine stocks to act as controls. In spring, on the American vines, numerous primary galls, *i.e.* those produced by the stem-mother, appeared, which proved that the winter-egg had remained alive. The European vines, on the other hand, were almost always exempt. The roots of both kinds were invariably uninjured. It has thus been proved in the most definite manner that in no case can the insect which is newly hatched from the winter-egg live on the roots. If it has the chance of migrating to the young leaves, or to other green parts of the American vine adapted to it, it forms a gall, and here, after having completed four moults, becomes sexually mature and lays its eggs. If it finds itself on the green parts of European vines, or of certain American vines not adapted to its existence, it punctures the plant, but does not succeed in producing a gall, and dies.

It is necessary to note that the same sorts of vine do not always behave in a similar manner. The stem-mother lays an enormous quantity of eggs over a period lasting about a month, which hatch in eight to twelve days. Individuals from eggs laid during the first few weeks all make their way to the leaves, where they may develop. Those from later eggs pass to the roots; these, however, are generally few in number. It is a remarkable fact that the migration of the newly-hatched individuals to the underground rather than to the aerial portions of the plant, is connected with the presence of easily identifiable morphological characters, so that their destination may be deduced from their appearance. The author therefore assigns different names to the two kinds of newly-hatched individuals. He applies the name neogallicolae-gallicolae to the newly hatched females of gallicolae which will, in their turn, become gallicolae, and that of neogallicolae-radicolae to the newly hatched females of gallicolae which will become radicolae. The most important practical consequence of these observations is that the newly-hatched insect from the winter-egg does not develop on European vines. Exceptional cases are so rare that they may be practically neglected. No differences can be observed between the newly-hatched leaf and root forms with the naked eye, but under the microscope somewhat important structural differences are obvious; intermediate forms exist, but their history always follows that of the type they most resemble. As the number of generations increases, the quantity of eggs laid by the gallicolae, becomes gradually smaller, and simultaneously, by observing the single, newly-hatched individuals that emerge, the proportion of neogallicolae-gallicolae to neogallicolae-radicolae may be seen to decrease. It has

been shown by a series of experiments that, when the egg of the gallicola is laid, the type of larva to which it will give birth is already determined; external conditions such as the season, kind of vine, and others not yet known, exercise, on the other hand, an influence on the mother, in the sense of changing the relation between the number of eggs that will develop in one particular way or the other. It may be stated as a general fact that neogallicolae-gallicolae are born in greater numbers when the vine is in a state of active growth, while neogallicolae-radicolae are almost exclusively produced when the season is advanced and, in general, when the vine is no longer producing any new leaves. By transporting artificially neogallicolae-gallicolae from one plant to another, offspring may be obtained in which the proportion between neogallicolae-gallicolae and neogallicolae-radicolae differs from that encountered in the sister neogallicolae-gallicolae remaining on the original vine. A neogallicola-gallicola never develops wings; therefore the winged forms, which observers have occasionally found in galls do not represent the winged form of a gallicola, but are merely winged radicolae developed in exceptional circumstances in an environment not habitual to them. The parallel drawn by Franceschini between the root and leaf form, based on the supposition that both could produce winged forms, and consequently sexual forms and a winter-egg, is therefore inadmissible. Neither, as Del Guercio has asserted, do the gallicolae produce alate forms after the first generation, nor do those producing radicolae live on the roots of every sort of vine. Artificial methods have been used both by the author and Börner, by means of which galls may be produced in any locality, where, in spite of many years infection by *Phylloxera*, they have not previously existed, and this, without introducing the insects from outside. It suffices, for example, to develop from nymphs a quantity of the winged insects in a hothouse where receptive American vines, with sufficiently large stocks, are growing. There is therefore no ground for attributing the capacity for forming a gall to certain varieties only of *Phylloxera*.

The product of the winter-egg on European vines is almost always destined to perish. The winter-egg is the only egg laid by the sexual forms, and the sexual individuals can only be produced by the winged insects; it follows that the winged insects also, contrary to the belief of most authors, may be considered non-existent as regards the spread of *Phylloxera* on European vines. The winged insects are, however, dangerous as regards spreading when it is possible for them to lay their eggs on American vines which are also capable of bearing galls. Recollecting, therefore, that the winged insects are either almost entirely male producing or entirely female-producing, a single casual visitor to a vine, even if this latter be receptive, cannot be capable of infecting it. The sterility of the alate forms is probably governed by conditions of environment which may exist in some years and not in others. Their absolute numbers must be large, though their percentage be small. The view that the alate forms are of two kinds is erroneous; all are sexuparous. Individuals resembling nymphs (ninfali) occur which closely resemble the apterous forms, but are nevertheless distinct from them; their eggs develop like those of apterous radicolae and do not give rise to sexual individuals; there is thus no possibility of a sexual generation independent of the winged insects. These "ninfali" constitute a

fifth form of *Phylloxera*. The fate of the eggs of the radicolae is not determined at the moment of oviposition, nor is that of the first larva; environment will determine whether the larva of a radicola will become an apterous radicola or a winged form. Winged forms develop in large numbers on American vines and also on the nodosities of European vines in some places, *e.g.* North Italy; but on European vines in the Pisan hills, they are everywhere rare and in some seasons extremely so. If, from an American vine, two rootlets are taken with first larvae already adhering to them, and one is left intact, and from the other, all the larvae are removed, except one, and the rootlets are then carefully kept alive until the insects have become mature, the isolated larva will always develop into an apterous form, whilst those remaining together, mainly become winged forms. By means of similar and often repeated experiments, the author has become convinced of this phenomenon in the first larvae; this has also been confirmed by Börner. After hibernating, the apterous forms never become winged, but that their female offspring may do so, is very probable, and is thought to be the case even by Börner, but is not as yet definitely proved.

The author's latest researches regarding emergence from the soil of the first larvae have shown that in infested vineyards enormous numbers of *Phylloxera* comes to the surface of the soil, where they run about like ants. These are almost all newly-hatched from the egg (first larvae). The importance of this phenomenon has been largely overlooked owing to the belief in the spread of *Phylloxera* by means of the alate forms, but it is really of great consequence. It is possible by careful examination, with the help of a lens, to see newly-hatched insects, identical with those found on the roots, wandering about on the ground near an infested vine. When the soil is very dry, watering it will produce fissures from which the newly-hatched insects can be seen to emerge. This emergence goes on all the time that the eggs are hatching on the roots, except in spring or in prolonged drought in summer. Local conditions have an important influence on the time and extent of this exit from the soil and a fall of rain will increase it immensely. The emergence of *Phylloxera* from the soil has now been observed throughout the whole of Italy and occurs in any soil compact enough to crack and fissure. It is now regarded as established that these larvae can be carried by the wind; infection in the direction of the prevailing wind has often been observed, and there is now little doubt but that small local outbreaks near a centre of infection are caused by migration of the larvae over the soil. They are clearly attracted by light, and this possibly accounts for their presence on the new rootlets thrown out by layered vines before they are to be found on the main roots of the stock. The first larva may in certain cases take to an aerial life on the vine and produce offspring capable of forming galls; adventitious roots would appear to facilitate this migration from the root to the leaf.

The question of the existence of different races of *Phylloxera* is discussed. Börner's work on the race or variety which he named *P. pervastatrix* in Lorraine, is reviewed. The author had intended to test this variety in an experimental vineyard in Italy, but was prevented from doing so by the outbreak of war. It is regarded as at least possible

that other varieties may be found in other countries and it is believed that such a variety, differing but little from *P. pervastatrix*, occurs in the province of Novara. The supposed existence of biological races may be of great practical importance and may be connected with the enormous differences between the results obtained in the fight against this pest. The worst ravages have occurred in regions where vineyards are specialised, the least, in those where the vines are kept high, planted in rows with intervening plots cultivated with herbaceous crops, or where they are trained on trees and at a good distance apart, etc. It has also been proved that the damage makes less rapid progress among vines in which the aerial and consequently also the underground portions, are well developed. Other factors have to be considered, such as the division of the property and the share system which exclude, more or less completely, extraneous factors capable of spreading *Phylloxera*. All these circumstances have their value, and the intensity and accuracy of methods with which the control of *Phylloxera* has been conducted, also count for something, but they still appear insufficient to give a complete explanation of all the phenomena under discussion. Something is still wanting, and this is contained in the following dilemma :—Either the *Phylloxera* becomes weakened or in certain localities becomes benign in response to its environment, or there are benign and malignant races of this pest. This seems to be the only really important point in the biology of *Phylloxera* which still requires elucidation, and experiments have already been begun with this object. This very important and detailed paper should be consulted in the original by all interested.

KOLMODIN (G.). **Grantorkan och barkborren.** [The dying of spruce and the spruce bark-beetle, *Ips typographus*.]—*Norrlands Skogsvårdsförbunds Tidskrift*, 1915, no. 3, 28 pp., 14 figs.

Most of the observations embodied in this paper were made in the forest reserve at Orsa in Dalecarlia, Sweden, which covers about 11,000 acres. Experiments showed that low temperatures do not affect the beetles beyond prolonging the life-cycle. In order to ascertain whether the beetles were the primary cause of the dying of the spruces, circulars were sent to 20 interested persons requesting them to state their experiences on this point. Of these, five answered that they considered the beetle the primary cause, seven did not consider this to be the case, and the rest had not formed any opinion. This diversity of opinion probably depends partly on the different behaviour of the beetles under different circumstances, and partly on the fact that the attacks are often discovered so late that the problem cannot be investigated. Both in 1913 and 1914 the bark beetle has undoubtedly been the primary cause of the dying of the spruces. In many instances it attacked perfectly healthy trees, including single ones, as well as those in groups. In Orsa and Hamra, at least one thousand trees were attacked one after the other. The bark beetles do not, however, cause primary damage to spruces unless they are present in comparatively large numbers, sufficient to attack healthy trees successfully. The author found several spruces which had been attacked by the beetles, but shortly afterwards had been abandoned by them,

probably because they were too few. The beetles are very seldom killed by the resin. During a serious attack about 300 holes per square metre are present, the tree or part of it being then killed. When the beetles are less numerous, they seem instinctively to avoid spreading over the whole tree and only attack part of it. The part chosen seems generally to be the southern or south-western side, the area being very elongated; the larger the tree, the larger the area. The cambium is destroyed and the external layer of the wood is dead and usually attacked by the fungus, *Ceratostoma piliferum.* The areas attacked were found at different heights on the trees, sometimes low down sometimes in the crown. As a rule, trees from 9 to 11 inches in diameter at about 5 feet from the ground, were preferred. The beetles attack the whole trunk, except near the base and at the top. The attack was never begun by *Ips chalcographus* at the top, this species always following the attack of *I. typographus.* It probably depends on climatic conditions how high up the attack takes place in the tree, the beetles flying higher during warm weather; this accounts for the fact that felled trap-trees are not often attacked, although growing trees in the vicinity are killed. The trees injured by the bark-beetles are generally attacked by the fungus, *C. piliferum*, which reduces the value of the timber. In order to prevent this, it is necessary to cut the attacked trees as soon as the larvae begin to develop, which at Orsa takes place in the beginning of June or later. As the development of the brood may be completed in six or eight weeks, and the attack may begin in May, the trees first attacked must be cut and the bark removed at the end of June, or earlier in the southern part of the country. In Orsa, the amount of timber destroyed by the bark-beetles in 1914 was approximately estimated at 70,000 cubic metres. The decrease in value caused by the fungus was about £3,850 and in the whole country the losses due to the bark-beetle amounted to some millions.

The best method of controlling the beetles is to remove the bark from the trunks attacked. Partial barking is not sufficient, as many beetles succeed in undergoing their transformation in the pieces of bark left, especially in dark and damp places. Partial barking does not affect *I. chalcographus* at all. The trees must therefore be barked so early in the year that the larval galleries are not more than 1 cm. long. In the middle of May, if the climatic conditions are favourable, the beetles may be found on the trunks; all the attacked trees must then be marked, and their diameter measured, so that all can be felled and barked in proper time. New swarms arrive later and attack the remaining trees, which must be watched, as well as the attacks higher up on the trunks, which are more difficult to detect. Whenever the attacked trees were cut and barked in good time, the result was most satisfactory, and the trunks did not suffer if they were stored in shady places. The beetles often leave localities where the conditions seem quite suitable, and in many of these cases the larvae appear to suffer from some disease.

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